COMMISSION ON WATER RESOURCE MANAGEMENT
ROUTE SLIP FOR PERMIT ISSUANCE


DATE: 03/26/04
SUSPENSE DATE: __________


TO: INIT. TO: INIT. FOR: PLEASE:

1 Approval 1 Signature 1 Review & Comment
3 Information 1 Take Action
2 Type Draft
4 File
Xerox copies

WELL NUMBER 4203-16 WELL NAME HSDP 1 well

☐ WELL CONSTRUCTION

ATTACHMENTS FOR WELL CONSTRUCTION PERMIT:
1 COVER LETTER
2 PERMIT (2x)
3 SDWB
4 WWB
5 CBW
6 HEER
7 LD
8 HP
9 PUMP TEST
10 WCR I FORM

TO BE SENT TO APPLICANT

☐ PUMP INSTALLATION

ATTACHMENTS FOR PUMP INSTALLATION PERMIT:
1 COVER LETTER
2 PERMIT (2x)
3 SDWB
4 WWB
5 CBW
6 HEER
7 LD
8 HP
9 WCR II FORM
10 WUR FORM

TO BE SENT TO APPLICANT

FOR OFFICE USE ONLY

This stuff makes our bulletin longer than it has to be.
August 31, 2004

Mr. Don Thomas
CSAV
University of Hawaii at Hilo
200 West Kawili Street
Hilo, HI 96720-9041

Dear Mr. Thomas:

Extension of Well Construction Permit for Well No. 4203-16

This is in response to your phone call on August 26, 2004 requesting an extension for the completion date of the HSDP 1 Well (Well No. 4203-16). Your request is approved. Your new completion date is September 1, 2006. All other conditions of your permit remain the same.

If you have any questions, please contact Ryan Imata of the Commission staff at 587-0255 or toll-free at 974-4000 (Hawaii), extension 70255.

Sincerely,

YVONNE Y. IZU
Deputy Director
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If no problems - o.k. to extend? Now pumping well.
Hope we don't have to wait for inquiry/complaint to get this done next time.
We need to meet dates in local files.
Can we bring more cows?
August 11, 2003

Mr. Donald Thomas
University of Hawaii at Manoa
Hawaii Institute of Geophysics and Planetology
School of Earth Science and Technology
1680 East West Road
Honolulu, HI 96822

Dear Mr. Thomas:

Extension of Well Construction Permit for Well No. 4203-16

This is in response to your letter dated July 29, 2003 requesting an extension for the completion date of the HSDP Well (Well No. 4203-16). Your request is approved. Your new completion date is September 1, 2004. All other conditions of your permit remain the same.

If you have any questions, please contact Ryan Imata of the Commission staff at 587-0255, extension 70255.

Sincerely,

[Signature]

ERNEST Y.W. LAU
Deputy Director

RI:ss
Subject: Extension of time for completion of the Well Construction Permit for HSDP Well (No. 4203-16)

I am writing to request an extension of the above referenced Well Construction Permit to allow us additional time to complete the borehole drilling activities planned under the Hawaii Scientific Drilling Project. Our progress on this research drilling project was quite successful in the first phase of core drilling that allowed us to complete coring to approximately 10,201 ft. However, we encountered a number of delays in acquisition of the heavier equipment that was required to complete our Phase II drilling program: after more than two years of effort to lease a locally-owned drilling rig, we ultimately were forced to fabricate our own rig for the project which delayed our planned drilling hiatus from 18 months to more than 36 months.

We have now opened the hole in preparation to setting casing to ~10,000'; after we set casing we will then be able to core drill toward our target depth of ~15,000'. Currently, operations in the well are suspended to allow downhole geophysical measurements to be performed in the deeper section of the hole. We may be forced to further suspend coring activities pending sale of the rotary drilling rig; the sale of the rig is being pursued because of higher than anticipated costs of our drilling and hole-opening efforts. With sale of the rig, we should be able to complete the planned coring efforts in a matter of a several months.

Mr. Imata of your staff has requested that I provide an interim Well Completion Report that provides additional detail on the work that has been completed to date. This is being provided with the present letter.
Because of our need to delay the start-up of coring activities for a presently uncertain time period, I would like to request that our permit expiration be extended until September 1, 2004.

Should there be any questions regarding the activities under this project, please contact me at your convenience at 895-6547 or at 956-6482.

Thank you for your consideration of this request and I apologize for not having submitted it in a more timely manner.

Enclosure
Cc: Donald Thomas
    Mr. Wick Sloane
State of Hawaii
COMMISSION ON WATER RESOURCE MANAGEMENT
Department of Land and Natural Resources

WELL COMPLETION REPORT - PART I
Well Construction

Instructions: Please print in ink or type and send completed report (with attachments, if applicable) to the Commission on Water Resource Management, P.O. Box 621, Honolulu, Hawaii 96809. The Commission may not accept incomplete reports. This form shall be submitted within 60 days of the completion of work. For assistance, please consult the Hawaii Well Construction and Pump Installation Standards or call the Regulation Branch at 587-0225. For updates to this form or additional information, please visit our website at http://www.hawaii.gov/dlnr/cwnm/

1. State Well No.: 4203-16  Well Name: HSDP Well
2. Address: Hilo International Airport, Haaaii  Tax Map Key: 2-1-12:9
3. Drilling Company: DOSECC, Inc.
4. Drilling method used during construction: ☐ Rotary  ☐ Percussion  ☑ Other (describe)
5. Date Well Construction (drilled, cased, grouted) completed: currently sus.  Attach Driller's Log (7/26/99 DL Form)

In addition to the driller's log, if a geologic log was prepared, please submit with this form.

6. Was the subject well cored? ☑ Yes  ☐ No
7. Initial water-level encountered 15 ft. below ground
   Date and time of measurement: 03/15/1999 14:30

8. Step-Drawdown Test completed? ☑ No  ☐ Yes  (12/17/97 CRPTD Form)
9. Constant Rate Aquifer Test completed? ☑ No  ☐ Yes  (7/26/99 SDPTD Form)

Parameters prior to pump test:
10. Water-level: ______________ ft. above msl
11. Chloride: ______________ ppm
12. Temperature: ______________ °F

13. Fill in the as-built section on the other side of this sheet.
15. If a pump is not planned to be installed, please describe (below in the remarks section) how well is secured to prevent unauthorized access (example: lockable cover, threaded coupling, etc.)
16. Remarks: This research well has been core drilled from the surface, followed by hole opening and setting of at various stages as coring progressed. Hydrostatic head (water level), chloride, and temperature have been highly variable with depth. Well is currently secured with wellhead valve and capped with monitoring feed-through

---

Licensed Driller (print) DOSECC Inc., Salt Lake City, UT  C-57 Lic. No. 
Signature ____________________________ Date ________

Surveyor (print) Imata and Associates  L.P.L.S. Lic. No. "4979"  Date 7-29-03
Signature ____________________________ Date ________

Permittee (print) University of Hawaii/Donald M. Thomas  Date July 24, 2003
WELL NUMBER: 4203-16

DRILLER'S LOG *(7/26/99 DL Form)*

<table>
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<th>Depths (ft.)</th>
<th>Rock Description, Water Level, etc.</th>
<th>Dates</th>
<th>Depths (ft.)</th>
<th>Rock Description, Water Level, etc.</th>
<th>Dates</th>
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Remarks:

A printed unit-by-unit summary of the lithology is attached to this report. A digital copy of all core logs and descriptions for this borehole is also provided in a two-CD set.

Groundwater was encountered approximately 15' below surface during initial drilling for conductor casing. Borehole began to flow fresh water with artesian head while drilling at ~1300'. Well continued to show artesian head through balance of coring and drilling to 10,201'.
Hawaii Scientific Drilling Project
Borehole Slab Layout
Memo

Kevin Gooding

May 24, 2003

Visit to the DOSECC drilling operation in Hilo

Don Thomas showed me around. It is the second biggest rig in Hawaii, 400,000 lbs of pullback capacity. The biggest is the Puna geothermal rig.

They have an almost all mainland crew. All the Hawaii people were on other jobs. They work 24 hours a day. Don is the scientist in charge.

They were making about 4000 gpm water at 100 psi a the platform so they had to cement back with neat cement about 2000 feet of hole. They have used about $200,000 of drilling mud so far so they want to minimize the waste.

This is the second phase of the drilling operation. Last time they cored to about 10,000 feet and cased part of the hole. Now they are reaming out the uncased part of the hole so that they can case it. They will use 5 inch casing. An odd size but it works perfectly for the 3 3/8 inch (?) core barrel.
August 25, 1993

Mr. Manabu Tagamori
Director
Water Resources Management Division
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96813

Dear Mr. Tagamori:

I would like to request from your Department, a permit that will allow me to drill a scientific research hole in the vicinity of Hilo Harbor. The proposed location of the drilling project is on portions of two State-owned parcels of land (TMK 2-1-09-1 and TMK 2-1-09-4) located between the Keaukaha sewage treatment plant and the Texaco fuel storage area on Kalanianaole Ave. (see attached map).

The purpose of the drilling project is to sample the lava flows that are present below this part of Hilo down to a depth of approximately 2000 ft. to 3000 ft. (see attached detailed discussion of the scientific objectives of the program). The drilling procedure will be identical to that used during the Scientific Observation Hole program, conducted in the Puna District by the University of Hawaii, in which samples of core were continuously removed from the hole during the drilling procedure. The drilling contractor that has been selected for the drilling program (Tonto Drilling Co.) will be the same one that performed that drilling and hence has had extensive experience in core drilling of Hawaiian basalts. The proposed hole will, however, not be as deep as those in Puna nor is this hole expected to encounter elevated temperatures.

The design of the proposed hole is as shown in the attached drawing. The upper section of casing will be approximately 4.5 inches in diameter and will be cemented in place down to a depth of between 75 ft. and 200 ft. depending on drilling conditions. The subsequent string of HQ casing will also be cemented in place to a depth of approximately 1200 ft. with the bottom hole interval left open to allow downhole logging measurements to be performed after well completion. (If adverse drilling conditions are encountered during drilling, a third string of casing may also be left in place at well completion.) The total depth of the hole will depend on the drilling conditions encountered as well as the duration of the drilling. The drilling time will be no more than 45 days as required by our Right-of-Entry (see below) issued by the Department of Land and Natural Resources, Land Management Division.

As noted above, we do not anticipate encountering elevated temperatures in the well. None-the-less, we will be monitoring downhole temperatures during drilling and, if unusual temperature increases are observed, we will immediately halt further drilling and notify your department. Our
Mr. Tagamori  
8/25/93  
Page 2

Drilling plan also includes the use of a BOPE to allow us to control any artesian aquifers that might be encountered. Finally, we will be both logging the hole during drilling and sampling fluids from the hole at intervals. This data can be provided to you as required.

The present status of the project is as follows:
1) A Right-of-Entry was issued by the Department of Land and Natural Resources, Land Management Division in June of this year. As part of this process, an Environmental Assessment was performed and resulted in a Negative Declaration by the Department. The Right-of-Entry and the EA are being forwarded to you under separate cover.
2) A Special Management Area Petition has been submitted to the County of Hawaii Planning Department. A public hearing for this petition will be heard by the Planning Commission on August 26, 1993; the recommendation by the Planning Director to the Commission is that the project be approved with appropriate conditions for mitigating noise and lighting impacts from the drilling project. A copy of the SMA petition is also being sent to you.

Thank you for your assistance on this request and, should you have any questions regarding our proposed project, please contact me at your convenience.

Sincerely yours,

Donald M. Thomas  
for: C.B. Raleigh  
Dean  
School of Ocean and Earth Science and Technology
Hilo. He has been with UH for 22 years and received a Bachelor of Science degree from Dickenson College in 1970 and a Master of Science in Geology in 1972 in Oregon Graduate Center, and received his PhD from UH Manoa in 1977.

3. Report by Don Thomas on Scientific Deep Well Project in Hilo with Emphasis on Hydrology

Dr. Thomas showed a powerpoint presentation on the background of the project on Mauna Kea. He stated that the understanding with respect to groundwater on the Island of Hawaii is very much out of date. This research project is called the Hawaii Scientific Growth Project. Dr. Thomas is the Principal Investigator of this project. The purpose of the project is to try to understand the planetary process that produce the Hawaiian Island chain. The structure of the Hawaiian volcano is being explored to see how it is forming.

During the drilling operation, the drill hole penetrated a shallow fresh water basal lens and underlying salt water within the upper Mauna Loa basalts. In a deeper layer between Mauna Loa and Mauna Kea, artesian fresh water was also encountered. When the drill hole entered the older Mauna Kea levas, another artesian zone was encountered. This water originated at an elevation of 7,000 feet on Mauna Kea and discharged through the drill pipe onto the rig floor at a rate of 2,000 gpm. This water was dated at 2,000 years old.

After this project is completed, Dr. Thomas would like to go back and reassess the groundwater. He would like to do work that would define the structures that are controlling groundwater flow, identify the aquifers to determine water chemistry and lastly determine the extent of yield of the resource.

4. APPLICATION FOR WELL CONSTRUCTION / PUMP INSTALLATION PERMITS, REQUEST FOR VARIANCE, H Brothers Well (Well No. 1229-03), Well Construction: 8-inch Casing Diameter, 1210-ft Deep Well, Pump Installation: 200 gpm for Irrigation use, TMK 9-6-5: 18, Hawaii

PRESENTATION OF SUBMITTAL: Ryan Imata

RECOMMENDATIONS:

A. Approve the issuance of a well construction permit for H Brothers Well (Well No. 1229-03), subject to the standard conditions in Exhibit 3, and the following special conditions:

1) The well should not be used for drinking water unless it is properly tested and treated.

2) If potable water is used to supply both domestic and irrigation purposes in a single system, the permittee shall eliminate cross-connections and backflow connections by physically separating potable and non-potable systems by an air gap or an approved backflow preventer, and by clearly labeling all non-
May 24, 1999.

Mr. Bob Jordan

VIA FAX: 974-7677

RE: Hilo International Airport Area
    HSDP 3 Well, Well No. 4203-17

Transmitted find:

1) Sketch (not to scale) showing elevations (mean sea level) and azimuth along edge of concrete slab; and

2) Copy of Invoice.

Sincerely Yours,
IMATA & ASSOCIATES, INC.

Clyde Matsunaga
WELL CONSTRUCTION

ATTACHMENTS FOR WELL CONSTRUCTION PERMIT:
1. COVER LETTER
2. PERMIT (2x)
3. PUMP TEST
4. DOH COMMENTS
5. WCR FORM

TO BE SENT TO APPLICANT

FOR OFFICE USE ONLY

PUMP INSTALLATION PERMIT FOR: 4203-16 HSOP well

ATTACHMENTS FOR PUMP INSTALLATION PERMIT:
1. COVER LETTER
2. PERMIT (2x)
3. DOH COMMENTS
4. WCR FORM
5. WUR FORM

TO BE SENT TO APPLICANT

FOR OFFICE USE ONLY
Mr. Eugene S. Imai
University of Hawaii
Bachman Hall
2444 Dole Street
Honolulu, Hawaii 96822

Dear Mr. Imai:

Well Construction Permit
HSDP Well (Well No. 4203-16)

Enclosed are two (2) copies of your approved Well Construction Permit for the captioned well(s) which authorizes well construction activities but excludes installation work for your permanent pump. As part of the Chairperson's approval, the following special conditions were added and are part of your permit under Permit Condition 12:

Special Conditions

1. Attached for your information is a copy of the Department of Health's (DOH) review comments. Please note DOH's requirements related to discharge of effluent from well drilling and testing activities.

2. Daily reports of temperature surveys during all hole advance operations (coring/drilling) shall be submitted to the Commission.

3. All chemical analyses of fluid samples collected shall be submitted to the Commission upon completion of fluid analyses.

4. All Blow Out Prevention Equipment (BOPE) and cemented casing strings shall be pressure tested before commencing any other operation on the well. The minimum test pressures shall be approximately one-third of the casing internal yield pressure rating, provided that the test pressure shall not be less than 600 psig nor greater than 2500 psig, and shall be applied for a period of thirty minutes. The results of the pressure tests shall be reported to the Department.

If a drop of more than ten percent of the casing test pressure is recorded, the operator shall run a caliper log and/or other appropriate well test to determine if the casing is defective and if corrective measures will be required before commencing any further operations. The results of the prescribed casing tests and any remedial work conducted shall be submitted to the Department within sixty days after completion.
5. Vertical angle measurements shall be conducted at intervals of not less than 300 feet. If the vertical angle measurement indicates deviation greater than 10 degrees, a complete directional survey including vertical angles and azimuth of the entire length of the well may be required.

6. During all hole advance operations (coring/drilling) between the depth of 0 to 2,000 feet, a minimum of one (1) temperature survey, yielding maximum downhole temperature, shall be conducted every 200 feet or every 24 hour period, whichever is shorter. If measured temperatures exceed 50°C, and the temperature gradient exceeds 50°C per kilometer, then temperature measurements shall be conducted either once per 100 ft. of hole advance or once per 12 hours, whichever is shorter.

7. Should down-hole temperatures exceed 50°C and temperature gradients exceed 50°C per kilometer during hole advance operations (coring/drilling) between 400 ft. and 2000 ft., Blow Out Prevention Equipment (BOPE) shall be installed on the 13 3/8" casing. However, if such temperatures are encountered when drilling is near the 2000' casing depth, the 9 5/8" casing shall be installed with the required BOPE before drilling is allowed to continue. Below 2000', an annular Preventer and diverter shall be installed on the 9 5/8" casing. If the temperature in the formation being drilled below 2000 ft. exceeds 50°C, a wireline lubricator shall be installed on the core rod for retrieval of core barrels from the bottom hole assembly. If the temperature below 2000' exceeds 50% of the temperature of boiling at the hydrostatic pressure of the formation being drilled, then the annular BOPE shall be replaced with a hydraulic double gate Type A with blind rams and pipe rams.

8. The permittee, its successors and assigns shall indemnify, defend, and hold the Department of Land and Natural Resources harmless from and against any loss, liability, claim, or demand for property damage, personal injury and death arising out of any act or omission of the applicant, assigns, officers, employees, contractors and agents under this permit or relating to or connected with the granting of this permit.

9. If changes to the proposed drilling program are contemplated, the permittee shall obtain the Chairperson's approval before executing such changes.

10. During the use of the well for testing and/or monitoring purposes, the well and site shall be properly maintained until the well is plugged and abandoned in accordance with the Department's administrative rules, Chapter 15-168 HAR and the Hawaii Well Construction and Pump Installation Standards.

11. The Permittee shall submit to the Chairperson, the results of any exploration, all drilling and testing records, down-hole surveys of the well, bottom-hole location, date of completion, and a survey of the well location and elevation above mean sea level taken by a Hawaii licensed surveyor within six months after completion of the well.

12. This permit is exempt the requirement (described in Standard Condition 2 of the Well Construction Permit) of Installation of a permanent minimum one-inch diameter monitor tube. All other requirements as described in Standard Condition 2 remain applicable.

13. This permit is exempt from Standard Condition 3 as described in the Well Construction Permit.
This permit does not authorize work for your permanent pump installation. Approval and issuance of your pump installation permit is contingent upon completed application and information provided to and accepted by Commission staff as required in the Well Construction & Pump Installation Standards (1/23/97) and any special conditions performed under this permit. However, in accordance with the Commission’s April 15, 1998 Declaratory Ruling No. DEC-ADM98-G5, which states that:

"Permanent pump installation for capacities between 0-70 gpm and where the proposed use is for private individual needs in non-ground-water management areas may be allowed prior to the final pump installation permit issuance. When required as a condition of the well construction permit, subsequent pumping tests shall validate the acceptability of the permanent pump. The permanent pump installed prior to final pump installation permit issuance is subject to removal if the testing shows that a smaller pump is required to reduce the potential of affecting neighboring wells and localized upconing at the applicant's well."

a permanent pump may be installed prior to the permanent pump installation permit issuance. If you qualify and wish to take advantage of this ruling, please include a written request to install the permanent pump prior to final pump installation permit issuance when you return to us your validated well construction permit.

To validate your permit, please sign and have the contractor sign both permit originals and return one for our files. Also, copies of the aquifer pump test worksheet and the well completion report form are enclosed for your use. Please provide all the information in this packet to your well drilling contractor.

IMPORTANT - The well permittee is responsible for all conditions of the permit. This includes ensuring that the well construction contractor, or other party who constructs the well(s), submits a completed Part I of the Well Completion Report form (enclosed) within sixty (60) days after the well construction work is completed. Be advised that you may be subject to fines of up to $1000 per day for any violations of your permit conditions starting from the date of this permit approval.

If you have any questions, please call the Commission staff at 587-0255.

Aloha,

[Signature]

for: TIMOTHY E. JOHNS
Chairperson

Enclosures
WELL CONSTRUCTION PERMIT
HSDP Well, Well No. 4203-16

In accordance with Department of Land and Natural Resources, Commission on Water Resource Management’s Administrative Rules, Section 13-168, entitled “Water Use, Wells, and Stream Diversion Works”, this document permits the construction and testing of HSDP Well (Well No. 4203-16) at Hilo International Airport, Hawaii, TMK 2-1-12: 9, subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97) which include but are not limited to the following conditions:

1. The Chairperson of the Commission on Water Resource Management (Commission); P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work authorized by this permit commences.

2. The well construction permit shall be for construction and testing of the well only. A minimum one-inch diameter monitor tube shall be permanently installed, in a manner acceptable to the Chairperson, to accurately record water levels. The permittee shall coordinate with the Chairperson and conduct a pumping test in accordance with the Standards (a pump testing worksheet is attached). The permittee shall submit to the Chairperson the test results as a basis for supporting an application to install a permanent pump and withdraw water for use. No permanent pump may be installed until a pump installation permit is approved and issued by the Chairperson.

3. In basal ground water, the depth of the well may not exceed one-fourth (1/4) of the theoretical thickness (41 times initial head) of the basal ground water unless otherwise authorized by the Chairperson.

4. The permittee shall incorporate mitigation measures to prevent construction debris from entering the aquatic environment, to schedule work to avoid periods of high rainfall, and to revegetate any cleared areas as soon as possible.

5. In the event that subsurface cultural remains such as artifacts, burials or concentrations of shells or charcoal are encountered during construction, the permittee shall stop work and contact the Department’s Historic Preservation Division (587-0045) immediately.

6. The proposed well construction shall not adversely affect existing or future legal uses of water in the area, including any surface water or established instream flow standards. This permit or the authorization to construct the well shall not constitute a determination of correlative water rights.

7. The following shall be submitted to the Chairperson within sixty (60) days after completion of work:
   b. Elevation (referenced to mean sea level, msl) survey by a Hawaii-licensed surveyor.
   c. As-built sectional drawing of the well.
   d. Plot plan and map showing the exact location of the well.
   e. Complete pumping test records, including time, pumping rate, drawdown, chloride content, and other data.

8. The permittee shall comply with all applicable laws, rules, and ordinances; non-compliance may be grounds for revocation of this permit.

9. The well construction permit application is incorporated into this permit by reference and is subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97).

10. The permit may be revoked if work is not started within six (6) months after the date of approval or if work is suspended or abandoned for six (6) months, unless otherwise specified. The work proposed in the well construction permit application shall be completed within two (2) years from the date of permit approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than three (3) months prior to the date the permit expires. If the commencement date is not met, the Commission may revoke the permit after giving the permittee notice of the proposed action and an opportunity to be heard.

11. If the well is not to be used it must be properly capped. If the well is to be abandoned then the permittee must apply for a well abandonment permit in accordance with §13-168-12(f) prior to any well sealing or plugging work.

12. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

Date of Approval: February 3, 1999
Expiration Date: February 3, 2001

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $1000 per day starting from the permit date of approval.

Permittee’s Signature: ___________________________ Date: ___________________________

Printed Name: ___________________________ Firm or Title: ___________________________

Driller’s Signature: ___________________________ License #: ___________________________ Date: ___________________________

Printed Name: ___________________________ Firm or Title: ___________________________

Please sign both copies of this permit, return one to the Chairperson, and retain the other for your records.

Attachment
C: USGS
Department of Health/ Safe Drinking Water, Wastewater, and Clean Water Branches
Hawaii Department of Water Supply
Department of Transportation, Airports Division
TO: Honorable Lawrence Miike, Director
Department of Health
Attention: Dennis Tulang, Wastewater Branch
William Wong, Safe Drinking Water Branch

FROM: Michael D. Wilson, Chairperson
Commission on Water Resource Management

SUBJECT: Well Construction Permit Application
HSDP Wells (Well Nos. 4203-16 and 17)

Transmitted for your review and comment is a copy of the captioned well application.

We would appreciate your comments on the captioned application for any conflicts or inconsistencies with the programs, plans, and objectives specific to your department. Please respond by returning this cover memo form by June 20, 1998.

Please find a map, attached, to locate the proposed well. If you have any questions about this permit application, request additional information, or request additional review time, please contact Mr. Ryan Imata of the Commission staff at 587-0255.

RESPONSE:

[ ] This well qualifies as a source which will serve as a source of potable water to a public water system (serving 25 or more people at least 60 days per year or has 15 or more service connections) and must receive Director of Health approval prior to its use to comply with Hawaii Administrative Rules (HAR), Title 11, Chapter 20, Rules Relating to Potable Water Systems, §11-20-9.

[ ] This well does not qualify as a source serving a public water system (serves less than 25 people or more people at least 60 days per year or 15 service connections) and if the well water is used for drinking, the private owner should test for bacteriological and chemical presence before initiating such use and routinely monitor the water quality thereafter. However, if future planned use from this source increases to meet the public water system definition then Director of Health approval is required prior to implementation.

[ ] If the well is used to supply both potable and non-potable purposes in a single system, the user shall eliminate cross-connections and backflow connections by physically separating potable and non-potable systems by an air gap or an approved backflow preventer, and by clearly labeling all non-potable spigots with warning signs to prevent inadvertent consumption of non-potable water. Backflow prevention devices should be routinely inspected and tested.

[ ] It does not appear that this well will be used for consumptive purposes and is not subject to Safe Drinking Water Regulations.

[ ] For the applicant's information, a source of possible wastewater contamination [ ] is not located near the proposed well site (information attached).

[ ] Other relevant DOH rules/regulations, information, or recommendations are attached.

[ ] No comments/objections

Contact Person: Lori N. Kajiwara
Phone: 586-4294

Signed: Lori N. Kajiwara
Date: 6/15/98
TO: Honorable Lawrence Miike, Director  
Department of Health  
Attention: Dennis Tulang, Wastewater Branch  
William Wong, Safe Drinking Water Branch

FROM: Michael D. Wilson, Chairperson  
Commission on Water Resource Management

SUBJECT: Well Construction Permit Application  
HSDP Wells (Well Nos. 4203-16 and 17)

Transmitted for your review and comment is a copy of the captioned well application.

We would appreciate your comments on the captioned application for any conflicts or inconsistencies with the programs, plans, and objectives specific to your department. Please respond by returning this cover memo form by June 20, 1998.

Please find a map, attached, to locate the proposed well. If you have any questions about this permit application, request additional information, or request additional review time, please contact Mr. Ryan Imata of the Commission staff at 587-0255.

RESPONSE:

[ ] This well qualifies as a source which will serve as a source of potable water to a public water system (serving 25 or more people at least 60 days per year or has 15 or more service connections) and must receive Director of Health approval prior to its use to comply with Hawaii Administrative Rules (HAR), Title 11, Chapter 20, Rules Relating to Potable Water Systems, §11-20-29.

[ ] This well does not qualify as a source serving a public water system (serves less than 25 people or more people at least 60 days per year or 15 service connections) and if the well water is used for drinking, the private owner should test for bacteriological and chemical presence before initiating such use and routinely monitor the water quality thereafter. However, if future planned use from this source increases to meet the public water system definition then Director of Health approval is required prior to implementation.

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[ ] For the applicant's information, a source of possible wastewater contamination [ ] is not located near the proposed well site (information attached).

[ ] Other relevant DOH rules/regulations, information, or recommendations are attached.

[ ] No comments/objections

Contact Person: William Wong  
Phone: 586-4258  
Signed: William Wong  
Date: 06/12/98
The Department of Health, Clean Water Branch has the following comments:

1. For Well-Drilling Activities

Any discharge to State waters of treated process wastewater effluent associated with well drilling activities is regulated by Hawaii Administrative Rules, Chapter 11-55, Appendix I, effective September 22, 1997. Treated process wastewater effluent covered by this general permit includes well drilling slurries, lubricating fluids wastewaters, and well purge wastewaters. This general permit does not cover well pump testing. The applicable Notice of Intent Forms and filing fee shall be submitted at least thirty (30) days before the start of discharge to the Department of Health, Clean Water Branch at 919 Ala Moana Boulevard, Room 301, Honolulu, Hawaii 96814-4920 or P.O. Box 3378, Honolulu, Hawaii 96801-3378. Inquiries may be directed to the Clean Water Branch at (808) 586-4309 or by fax at (808) 586-4352.

2. For Well Pump Testing

The discharger shall take all measures necessary to prevent the discharge of pollutants from entering state waters. Such measures shall include, if necessary, containment of the initial discharge until the discharge is essentially free of pollutants. If the discharge is entering a stream or river bed, best management practices shall be implemented to prevent the discharge from disturbing the clarity of the receiving water. If the discharge is entering a storm drain, the discharger must obtain written permission from the owner of that storm drain prior to discharge. Furthermore, best management practices shall be implemented to prevent the discharge from collecting sediments and other pollutants prior to entering the storm drain.

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I announced this note and the document was issued but not returned signed yet.
Memo To: Mr. Timothy Johns  
Chair, Commission on Water Resources Management

Via: Mr. Ed Sakota  
Deputy Director

From: Donald Thomas  
HSDP Project Director

Subject: Initiation of drilling activities for Hawaii Scientific Drilling Project Wells

By way of this memo, we would like to notify you of the anticipated start dates for the Hawaii Scientific Drilling Project deep well and temporary water well. The anticipated start date for drilling and coring of the deep hole, Well No. 4203-16, is March 15, 1999.

Currently work is underway preparing the site for the large drill rig and science trailers. Drilling of the temporary water well, to provide drilling water for the rotary rig, Well No. 4203-17, will be done as part of that work and will be initiated within the next two weeks.

Should you have any questions regarding this work, please contact me at your convenience at 956-6482.

Thank you.
Prog -

Here are signed copies of the drilling permit for the deep hole 4203-15 and the temporary water well 4203-17.

Please give me a call if I need to submit anything more.

call @ 895 - 6597
STATE WATER RESOURCE MANAGEMENT COMMISSION

PRIVATE SOURCES

(WATER USE PERMITS)

BWS "POT"

(ALLOCATIONS)
Memo To: Mr. Timothy E. Johns  
Chair, Commission on Water Resources Management  

Via: Mr. Ed Sakota  
Acting Deputy Director  

From: Dennis Nielson  
Executive Director, DOSECC  

Donald Thomas  
Principal Investigator, Hawaii Scientific Drilling Project  

Subject: Validation of Well Construction Permit for HSDP Well, Wells No. 4203-16  

Enclosed please find a signed copy of the Well Construction Permit for Well No. 4203-16. The permittee for this well is the University of Hawaii; Dr. Thomas has been designated the Principal Investigator for the Hawaii Scientific Drilling Project by the University and will manage the overall drilling program.

We would like to bring to your attention several important aspects of the drilling program for the HSDP drillhole.

1) DOSECC is under subcontract to the University of Hawaii to serve as the general contractor for the drilling program and to manage the financial and technical issues associated with subcontracting for drilling services.

2) The drilling technology that will be applied during this project is known as diamond wireline core drilling and is not available in Hawaii. Hence, the University of Hawaii requested, and received, an exemption from the drilling licensing requirements from the Contractors Licensing Board of the Department of Commerce and Consumer Affairs (see attached letter).

3) DOSECC has retained the services of Tonto Drilling Company of Salt Lake City, UT, to provide diamond wireline core drilling expertise and to operate the coring system fabricated for this project. Although Tonto Drilling Company is not currently licensed in Hawaii, it is an internationally recognized wireline drilling company that has, in the past, performed core drilling services in many states in the US, including Hawaii, as well as in a number of foreign countries.
4) Rotary drilling services will be provided to the project by Water Resources International, a Hawaii based company, and who holds a Contractor’s License AC 5058 C-57-17737.

Should you have any questions regarding the enclosed permit, please contact Dr. Thomas at your earliest convenience at 956-6482.

Thank you.
Dear Mr. Imai:

At its May 26, 1998 meeting, the Contractors License Board ("Board") considered your May 12, 1998 request for an exemption from the licensing requirements pursuant to §444-2(9), Hawaii Revised Statutes, for DOSECC (Drilling, Observation and Sampling of the Earth’s Continental Crust).

The Board understands that you are seeking this exemption for DOSECC to perform wireline diamond core drilling and sampling of lava flows from Mauna Loa and Mauna Kea volcanoes to a depth of approximately 14,500 feet for scientific study. You represent that due to the highly specialized nature of this work, there is no qualified drilling company in Hawaii, Australia, Canada, South Africa, and the United States that has the capability and reliability to wireline core drill to the projected depth of your project. You also represent that no known wireline core drilling contractors had a coring system that was adequate for your needs and therefore contracted with DOSECC to fabricate the wireline coring systems and to provide the drilling services. You further represent that you do not expect to encounter elevated subsurface temperatures during the drilling of this hole and therefore you do not believe that the project will pose a danger to the public’s health, safety, and welfare.

Based solely on the representations made in your May 12, 1998 letter and those made at the meeting by Dr. Donald Thomas, the Board approved the requested exemption for only this one project.

Should you have any questions, please call me at (808) 586-2700.

Very truly yours,

Charlene L.K. Tamanaha
Executive Officer

CLKT:lp
WELL CONSTRUCTION PERMIT
HSDP Well, Well No. 4203-16

In accordance with Department of Land and Natural Resources, Commission on Water Resource Management's Administrative Rules, Section 13-168, entitled "Water Use, Wells, and Stream Diversion Works", this document permits the construction and testing of HSDP Well (Well No. 4203-16) at Hilo International Airport, Hawaii, TMK 2-1-12: 9, subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97) which include but are not limited to the following conditions:

1. The Chairperson of the Commission on Water Resource Management (Commission), P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work authorized by this permit commences.

2. The well construction permit shall be for construction and testing of the well only. A minimum one-inch diameter monitor tube shall be permanently installed, in a manner acceptable to the Chairperson, to accurately record water levels. The permittee shall coordinate with the Chairperson and conduct a pumping test in accordance with the Standards (a pump testing worksheet is attached). The permittee shall submit to the Chairperson the test results as a basis for supporting an application to install a permanent pump and withdraw water for use. No permanent pump may be installed until a pump installation permit is approved and issued by the Chairperson.

3. In basal ground water, the depth of the well may not exceed one-fourth (1/4) of the theoretical thickness (41 times initial head) of the basal ground water unless otherwise authorized by the Chairperson.

4. The permittee shall incorporate mitigation measures to prevent construction debris from entering the aquatic environment, to schedule work to avoid periods of high rainfall, and to revegetate any cleared areas as soon as possible.

5. In the event that subsurface cultural remains such as artifacts, burials or concentrations of shells or charcoal are encountered during construction, the permittee shall stop work and contact the Department's Historic Preservation Division (587-0045) immediately.

6. The proposed well construction shall not adversely affect existing or future legal uses of water in the area, including any surface water or established instream flow standards. This permit or the authorization to construct the well shall not constitute a determination of correlative water rights.

7. The following shall be submitted to the Chairperson within sixty (60) days after completion of work:
   b. Elevation (referenced to mean sea level, msl) survey by a Hawaii-licensed surveyor.
   c. As-built sectional drawing of the well.
   d. Plot plan and map showing the exact location of the well.
   e. Complete pumping test records, including time, pumping rate, drawdown, chloride content, and other data.

8. The permittee shall comply with all applicable laws, rules, and ordinances; non-compliance may be grounds for revocation of this permit.

9. The well construction permit application is incorporated into this permit by reference and is subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97).

10. The permit may be revoked if work is not started within six (6) months after the date of approval or if work is suspended or abandoned for six (6) months, unless otherwise specified. The work proposed in the well construction permit application shall be completed within two (2) years from the date of permit approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than three (3) months prior to the date the permit expires. If the commencement date is not met, the Commission may revoke the permit after giving the permittee notice of the proposed action and an opportunity to be heard.

11. If the well is not to be used it must be properly capped. If the well is to be abandoned then the permittee must apply for a well abandonment permit in accordance with §13-168-12(f) prior to any well sealing or plugging work.

12. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

Date of Approval: February 3, 1999
Expiration Date: February 3, 2001

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $1000 per day starting from the permit date of approval.

Permittee's Signature: [Signature]
Printed Name: Eugene S. Imai
Firm or Title: University of Hawaii

Driller's Signature: [Signature]
License #: [License Number]
Date: 2/22/99
Printed Name: Dennis L. Nelson
Firm or Title: DOECC, Inc.

Please sign both copies of this permit, return one to the Chairperson, and retain the other for your records.

Attachment
C:
USGS
Department of Health! Safe Drinking Water, Wastewater, and Clean Water Branches
Hawaii Department of Water Supply
Department of Transportation, Airports Division
Notes: Ryan,
Here is the notification. I will send a paper copy by mail.

Please let me know if you see any problems with it.

Thank you.

Don Thomas
Memo To: Mr. Timothy Johns  
Chair, Commission on Water Resources Management

Via: Mr. Ed Sakota  
Deputy Director

From: Donald Thomas  
HSDP Project Director

Subject: Initiation of drilling activities for Hawaii Scientific Drilling Project Wells

By way of this memo, we would like to notify you of the anticipated start dates for the Hawaii Scientific Drilling Project deep well and temporary water well. The anticipated start date for drilling and coring of the deep hole, Well No. 4203-16, is March 15, 1999.

Currently work is underway preparing the site for the large drill rig and science trailers. Drilling of the temporary water well, to provide drilling water for the rotary rig, Well No. 4203-17, will be done as part of that work and will be initiated within the next two weeks.

Should you have any questions regarding this work, please contact me at your convenience at 956-6482.

Thank you.

Telephone: (808) 956-6482  Facsimile: (808) 956-2538  Email: dthomas@elepaio.soest.hawaii.edu
Memo To: Ryan Imata  
Water Commission

From: Donald Thomas

Subject: Restoration of permit for Well 4203-17

I have recently received a copy of our revised Well Construction Permit for HSDP Well (Well No. 4203-16) with the additional conditions that address the possibility of encountering subsurface pressure or temperature. However, it was my understanding from previous correspondence (dated September 4) that our permits for both Well No. 4203-16 and 4203-17 were suspended. Do I need specific instructions that the permit for well 4203-17 has been restored or may I assume that, since the well construction issues regarding 4203-16 have been resolved, that the permit for 4203-17 is also restored?

Thank you for your assistance.
FROM: Ryan  DATE: 12/10/98  SUSPENSE DATE ________________________________

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For when you're pan checking, ill fax to Don Thomas & Eric Tondekar.
To: Eric Tanaka
Company: Land Division
Fax Number: 974-6222
Phone Number:

From: Ryan Imata
Date: December 11, 1998
Pages Including Header: 5

Subject: Draft permit for UH HSDP wells

Notes/Comments:

Attached is a copy of the draft well construction permit. Please provide comments at earliest convenience.
Mr. Eugene S. Imai  
University of Hawaii  
Bachman Hall  
2444 Dole Street  
Honolulu, Hawaii 96822

Dear Mr. Imai:

Well Construction Permit  
HSDP Well (Well No. 4203-16)

Enclosed are two (2) copies of your approved Well Construction Permit for the captioned well(s) which authorizes well construction activities but excludes installation work for your permanent pump. As part of the Chairperson's approval, the following special conditions were added and are part of your permit under Permit Condition 12:

Special Conditions

1. Attached for your information is a copy of the Department of Health's (DOH) review comments. Please note DOH's requirements related to discharge of effluent from well drilling and testing activities.

2. Daily reports of temperature surveys shall be submitted to the Commission.

3. All chemical analyses of fluid samples collected shall be submitted to the Commission upon completion of fluid analyses.

4. All Blow Out Prevention Equipment (BOPE) and cemented casing strings shall be pressure tested before commencing any other operation on the well. The minimum test pressures shall be approximately one-third of the casing internal yield pressure rating, provided that the test pressure shall not be less than 600 psig nor greater than 2500 psig, and shall be applied for a period of thirty minutes. The results of the pressure tests shall be reported to the Department.

   If a drop of more than ten percent of the casing test pressure is recorded, the operator shall run a caliper log and/or other appropriate well test to determine if the casing is defective and if corrective measures will be required before commencing any further operations. The results of the prescribed casing tests and any remedial work conducted shall be submitted to the Department within sixty days after completion.

5. Vertical angle measurements shall be conducted at intervals of not less than 300 feet. If the vertical angle measurement indicates deviation greater than 10 degrees, a complete directional survey including vertical angles and azimuth of the entire length of the well may be required.
6. During drilling operations between the depth of 0 to 2,000 feet, a minimum of one (1) temperature survey, yielding maximum downhole temperature, shall be conducted every 200 feet or every 24 hour period, whichever is shorter. If measured temperatures exceed 50°C, and the temperature gradient exceeds 50°C per kilometer, then temperature measurements shall be conducted either once per 100 ft. of hole advance or once per 12 hours, whichever is shorter.

7. Should down-hole temperatures exceed 50°C and temperature gradients exceed 50°C per kilometer while drilling between 400 ft. and 2000 ft., Blow Out Prevention Equipment (BOPE) shall be installed on the 13 3/8" casing. However, if such temperatures are encountered when drilling is near the 2000' casing depth, the 9 5/8" casing shall be installed with the required BOPE before drilling is allowed to continue. Below 2000', an annular preventer and diverter shall be installed on the 9 5/8" casing. If the temperature in the formation being drilled below 2000 ft. exceeds 50°C, a wireline lubricator shall be installed on the core rod for retrieval of core barrels from the bottom hole assembly. If the temperature below 2000' exceeds 50% of the temperature of boiling at the hydrostatic pressure of the formation being drilled, then the annular BOPE shall be replaced with a hydraulic double gate Type A with blind rams and pipe rams.

8. The permittee, its successors and assigns shall indemnify, defend, and hold the Department of Land and Natural Resources harmless from and against any loss, liability, claim, or demand for property damage, personal injury and death arising out of any act or omission of the applicant, assigns, officers, employees, contractors and agents under this permit or relating to or connected with the granting of this permit.

9. If changes to the proposed drilling program are contemplated, the permittee shall obtain the Chairperson's approval before executing such changes.

10. During the use of the well for testing and/or monitoring purposes, the well and site shall be properly maintained until the well is plugged and abandoned in accordance with the Department's administrative rules, Chapter 13-168 HAR and the Hawaii Well Construction and Pump Installation Standards.

11. The Permittee shall submit to the Chairperson, the results of any exploration, all drilling and testing records, down-hole surveys of the well, bottom-hole location, date of completion, and a survey of the well location and elevation above mean sea level taken by a Hawaii licensed surveyor within six months after completion of the well.

12. This permit is exempt the requirement (described in Standard Condition 2 of the Well Construction Permit) of installation of a permanent minimum one-inch diameter monitor tube. All other requirements as described in Standard Condition 2 remain applicable.

13. This permit is exempt from Standard Condition 3 as described in the Well Construction Permit.

This permit does not authorize work for your permanent pump installation. Approval and issuance of your pump installation permit is contingent upon completed application and information provided to and accepted by Commission staff as required in the Well Construction & Pump Installation Standards (1/23/97) and any special conditions performed under this permit. However, in accordance with the Commission's April 15, 1998 Declaratory Ruling No. DEC-ADM98-G5, which states that:
Permanent pump installation for capacities between 0-70 gpm and where the proposed use is for private individual needs in non-ground-water management areas may be allowed prior to the final pump installation permit issuance. When required as a condition of the well construction permit, subsequent pumping tests shall validate the acceptability of the permanent pump. The permanent pump installed prior to final pump installation permit issuance is subject to removal if the testing shows that a smaller pump is required to reduce the potential of affecting neighboring wells and localized upconing at the applicant’s well."

a permanent pump may be installed prior to the permanent pump installation permit issuance. If you qualify and wish to take advantage of this ruling, please include a written request to install the permanent pump prior to final pump installation permit issuance when you return to us your validated well construction permit.

To validate your permit, please sign and have the contractor sign both permit originals and return one for our files. Also, copies of the aquifer pump test worksheet and the well completion report form are enclosed for your use. Please provide all the information in this packet to your well drilling contractor.

IMPORTANT - The well permittee is responsible for all conditions of the permit. This includes ensuring that the well construction contractor, or other party who constructs the well(s), submits a completed Part I of the Well Completion Report form (enclosed) within sixty (60) days after the well construction work is completed. Be advised that you may be subject to fines of up to $1000 per day for any violations of your permit conditions.

If you have any questions, please call the Commission staff at 587-0255.

Aloha,

MICHAEL D. WILSON
Chairperson

Enclosures
WELL CONSTRUCTION PERMIT
HSDP Well, Well No. 4203-16

In accordance with Department of Land and Natural Resources, Commission on Water Resource Management's Administrative Rules, Section 13-168, entitled "Water Use, Wells, and Stream Diversion Works", this document permits the construction and testing of HSDP Well (Well No. 4203-16) at Hilo International Airport, Hawaii, TMK 2-1-12: 9, subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97) which include but are not limited to the following conditions:

1. The Chairperson of the Commission on Water Resource Management (Commission), P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work authorized by this permit commences.

2. The well construction permit shall be for construction and testing of the well only. A minimum one-inch diameter monitor tube shall be permanently installed, in a manner acceptable to the Chairperson, to accurately record water levels. The permittee shall coordinate with the Chairperson and conduct a pumping test in accordance with the Standards (a pump testing worksheet is attached). The permittee shall submit to the Chairperson the test results as a basis for supporting an application to install a permanent pump and withdraw water for use. No permanent pump may be installed until a pump installation permit is approved and issued by the Chairperson.

3. In basal ground water, the depth of the well may not exceed one-fourth (1/4) of the theoretical thickness (41 times initial head) of the basal ground water unless otherwise authorized by the Chairperson.

4. The permittee shall incorporate mitigation measures to prevent construction debris from entering the aquatic environment, to schedule work to avoid periods of high rainfall, and to revegetate any cleared areas as soon as possible.

5. In the event that subsurface cultural remains such as artifacts, burials or concentrations of shells or charcoal are encountered during construction, the permittee shall stop work and contact the Department's Historic Preservation Division (587-0045) immediately.

6. The proposed well construction shall not adversely affect existing or future legal uses of water in the area, including any surface water or established instream flow standards. This permit or the authorization to construct the well shall not constitute a determination of correlative water rights.

7. The following shall be submitted to the Chairperson within sixty (60) days after completion of work:
   b. Elevation (referenced to mean sea level, msl) survey by a Hawaii-licensed surveyor.
   c. As-built sectional drawing of the well.
   d. Plot plan and map showing the exact location of the well.
   e. Complete pumping test records, including time, pumping rate, drawdown, chloride content, and other data.

8. The permittee shall comply with all applicable laws, rules, and ordinances; non-compliance may be grounds for revocation of this permit.

9. The well construction permit application is incorporated into this permit by reference and is subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97).

10. The permit may be revoked if work is not started within six (6) months after the date of approval or if work is suspended or abandoned for six (6) months, unless otherwise specified. The work proposed in the well construction permit application shall be completed within two (2) years from the date of permit approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than three (3) months prior to the date the permit expires. If the commencement date is not met, the Commission may revoke the permit after giving the permittee notice of the proposed action and an opportunity to be heard.

11. If the well is not to be used it must be properly capped. If the well is to be abandoned then the permittee must apply for a well abandonment permit in accordance with §13-168-12(f) prior to any well sealing or plugging work.

12. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

Date of Approval: December 8, 1998
Expiration Date: December 8, 2000

Michael D. Wilson, Chairperson
Commission on Water Resource Management

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $1000 per day.

Permittee's Signature: ____________________________ Date: __________
Printed Name: ____________________________ Firm or Title: __________

Driller's Signature: ____________________________ License #: __________ Date: __________
Printed Name: ____________________________ Firm or Title: __________

Please sign both copies of this permit, return one to the Chairperson, and retain the other for your records.

Attachment

C: USGS
Department of Health/ Safe Drinking Water, Wastewater, and Clean Water Branches
Hawaii Department of Water Supply
Department of Transportation, Airports Division
Please review Special Conditions. I made small revisions already in black. Maybe we need the "hold harmless clause" per Dean? Any sample wording? I've attached the comment sheets also.

When you're pan reviewing, I'll package with other stuff & route again up date well owner 2 permittee! (Post comment, etc.)
University of Hawaii at Manoa  
Hawaii Institute of Geophysics and Planetology  
School of Ocean and Earth Science and Technology  
2525 Correa Road • Honolulu, Hawaii 96822  
FAX Memo

Date: Tuesday, December 1, 1998  
To: Dean/Ryan  
Company: DWRM  
Fax Phone #: 5870219  
CC:  
From: Don Thomas  
Subject:  

Total # of Pages (including cover): 2

Memo: The following is the revised conditions for the drilling permit. The change from the prior condition is the addition of the 50 deg.C installation of a wireline lubricator for pulling core barrels.

Please let me know if you have any questions or need additional changes.

Thanks
DT
Proposed conditions:

3. During drilling operations between the depth of 0 to 2,000 ft., a minimum of one (1) temperature survey, yielding maximum downhole temperature, shall be conducted every 200 feet or every 24 hour period, whichever is shorter. If measured temperatures exceed 50°C and the temperature gradient exceeds 50°C per kilometer, then temperature measurements shall be conducted either once per 100 ft. of hole advance or once per 12 hours, whichever is shorter.

4. Should down-hole temperatures exceed 50°C and temperature gradients exceed 50°C per kilometer while drilling between 400 ft. and 2000 ft., Blow-Out Prevention Equipment (BOPE) shall be installed on the 13 3/8” casing. However, if such temperatures are encountered when drilling is near the 2000’ casing depth, the 9 5/8” casing shall be installed with the required BOPE before drilling is allowed to continue. Below 2000’, an annular preventer and diverter shall be installed on the 9 5/8” casing. If the temperature in the formation being drilled below 2000 ft. exceeds 50°C, a wireline lubricator shall be installed on the core rod for retrieval of core barrels from the bottom hole assembly. If the temperature below 2000 ft. exceeds 50% of the temperature of boiling at the hydrostatic pressure of the formation being drilled, then the annular BOPE shall be replaced with a hydraulic double gate Type A with blind rams and pipe rams.
FACSIMILE TRANSMITTAL PAGE

Please deliver the following pages to:

Name: Dean Nakano
Company: Water Resource Management
From: Eric Tanaka
Date: 11-5-98

Massages: Re: HSDP Well Permit Application

1. With the perforations in the water flow formation, the cement job will not be competent due to the cement going away into the formation. (If there are different separated water flows between dykes, there would be communication or co-mingling of these flow and would this be acceptable?)

Who will monitor the cement job when it is performed and the insure that the cement job is done correctly?

The D.O.E Equipment will have to be tested to insure the safety of the equipment and who will conduct or witness these tests?

A reporting procedure should be addressed as to the reporting of the test reports and the daily temperature logs to the commission. Due to the long range plans for this well, would the University keep the Commission advised as to the activity being done with the well?

(In the past, no communication has been done and no knowledge of activity taking place is known by the agency issuing the permit)

There should also be mentioned the end product for the well is the ultimate abandonment of the well in the future and the University should be held liable for the procedure. (Would the Commission do the abandonment if the University walks away from the well?)

The Commission should also mention the awareness to insure the public health and safety in addressing the well during the drilling phase and also the monitoring phase.

Total no. Of pages (including transmittal pages): 1
The original document will not be sent in the mail
If you do not receive all the pages legibly, please call (808) 974-6210
Sending Fax No.: (808) 974-6222
Receiving Fax No.: (808) 587-0219
Fax copy to: (808) 587-0219
Perforation Plan and Long-term Disposition of the Borehole

As discussed above in the drilling plan, at the conclusion of each drilling campaign, the drill rig will be demobilized from the site and a series of tests will be performed on the hole. These tests will include downhole temperature logging that will be conducted at progressively longer time intervals to monitor temperature recovery of the formation after circulation of drilling fluids has ceased. At the conclusion of these tests, the temperature profile will be analyzed to determine the formation depths where fluid temperatures suggest the presence of changing fluid compositions. The well casings will be perforated at these depths and fluid samples will be withdrawn for chemical and isotopic analysis. The number and depths of the perforations will be determined by the characteristics of the temperature profile determined after the completion of each stage of the hole.

The long-term plans for the hole are that it will serve as a geophysical observatory in which to make both long-term as well as short-term measurements. Because the completion of the hole is several years in the future, we have not solicited detailed proposals for its use after completion of the drilling and post-drilling testing program. We expect, however, that the hole will be used for recording of seismic activity, monitoring of deformation of the volcano flanks, and possibly long-term evaluation of gravitational changes associated with changes in magma flux through the Big Island’s volcanoes. The duration of these experiments could continue for several years to several decades.

What is the actual sequence in casing installation, perforation, and continued drilling? Will upper section 3" being down the casing (i.e. 7" inside 12") be installed after perforation/sampling before drilling is continued? Do we know what drilling proceeds your feeling across the perforated zone and setting casing to perf face up complete cementing of the annulus conditions?

4) Vertical angle measurements shall be conducted at intervals of no less than 300 feet. If the vertical angle measurement indicates deviation greater than 20°, a computer directed survey including vertical angles and azimuth of the entire length of the well may be required.
University of Hawaii at Manoa
Hawaii Institute of Geophysics and Planetology
School of Ocean and Earth Science and Technology
2525 Correa Road • Honolulu, Hawaii 96822
FAX Memo

Date: Wednesday, December 2, 1998
To: Ryan
Company: DWRM
Fax Phone #: 5870219
CC: 
From: Don Thomas
Subject:

Total # of Pages (including cover): 2

Memo: Ryan,
Here is a fax copy of the approval from the Contractor's License Board for the after the fact approval of the exemption from license requirements.

Please let me know if you need a paper copy or if this will be sufficient.

Thanks,
Don Thomas

Telephone: (808) 956-6482 • Facsimile: (808) 956-2538 • Email: dthomas@elepaio.soest.hawaii.edu
If all pages were not received, please call back immediately: 808 956-6482
MR EUGENE S IMAI
SENIOR VICE PRESIDENT FOR ADMINISTRATION
UNIVERSITY OF HAWAII
2444 DOLE ST
BACHMAN HALL
HONOLULU HI 96822

Dear Mr. Imai:

This is to confirm that the Contractors License Board, at its November 20, 1998 meeting, approved your request for an exemption from the license requirements pursuant to §444-2(9), Hawaii Revised Statutes, for the 1993 Hawaii Scientific Drilling Project.

Your letter of October 29, 1998 requested an after-the-fact exemption for Tonto Drilling Company of Salt Lake City, Utah, which drilled the diamond wireline core hole in late 1993 under contract with the University of Hawaii. The University has represented that the core hole was completed to a depth of 3,464 feet, that drilling conditions did not pose a health or safety threat to anyone, that temperatures in the deeper portion of the well were less than 45°F, and neither hazardous pressures nor hazardous fluid compositions were found. Dr. Donald Thomas, who was the project manager for the 1993 project, appeared before the Board and stated that to the best of his knowledge, there are fewer than ten contractors in the U.S. capable of performing this type of work.

Based solely on these representations, the Board approved the requested exemption for this particular project.

Should you have any questions, please call me at 586-2700.

Very truly yours,

Verna Oda
Executive Officer
COMMISSION ON WATER RESOURCE MANAGEMENT

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enough to accept? — didn't Darwin have this info?
Dear Mr. Johns:

Enclosed please find copies of a topographic map, a TMK map, and a site plot plan showing the drill site for the Hawaii Scientific Drilling Project Pilot Hole. I have also enclosed a copy of a letter that has been sent to the Executive Officer of the Department of Commerce and Consumer Affairs requesting an after-the-fact exemption for the drilling contractor that conducted the diamond wireline core drilling for that borehole.

Should you need additional information regarding that project, please contact me at your convenience.

Sincerely yours,

Donald Thomas
Dear Ms. Oda:

I am writing to request an after-the-fact contractors license exemption for the company that drilled a diamond wireline core hole in late 1993 under contract with the University of Hawai‘i. The basis for the exemption is Chapter 444-2(9) -- "Any project or operation where it is determined by the board that less than ten persons are qualified to perform the work in question and that the work does not pose a potential danger to public health, safety, and welfare."

The following information is pertinent to this request:

The research project for which the drilling was contracted was done under a permit issued by the Division of Water and Land Development. At the time of issuance of the permit, in 1993, no information was provided to us regarding the necessity to have a licensed drilling contractor perform this work.

We have recently been informed by the Water Resources Commission staff that their interpretation of the law is that the permit issued by DOWALD did not exempt the University from the requirement that a well drilling permit be obtained from the Water Resources Commission. We have subsequently submitted an after-the-fact permit application for that well. Upon submission of the permit application, we have been informed that we will need to request for an after-the-fact exemption for the contractor who performed the drilling work.

A Hawai‘i-licensed wireline diamond core drilling company was not used for this project because there are no such companies in Hawai‘i. Wireline diamond core drilling is a highly specialized technology that is typically used for minerals exploration. The drilling rig is substantially different from that used for water well drilling; the drilling tools (bits, collars, bottomhole assemblies, drilling rod, etc.) are different from (and incompatible with) water well drilling equipment; and the management of the drill rig (in terms of the weight-on-bit, the drillstring torque and the rotation rate) are also different from water well practices. Hence, use of a Hawai‘i-licensed water well contractor to conduct the core drilling would not have been
possible. We were, therefore, required to obtain the drilling capability necessary for completion of this project from the mainland.

A follow-on scientific drilling project is presently in the planning stages. We have requested and received an exemption from the Department of Commerce and Consumer Affairs for the drilling contractor for that project (documentation is attached).

The core hole that was drilled in 1993 was completed to a depth of 3,464 feet. Drilling conditions did not pose a health or safety threat to anyone; temperatures in the deeper portion of the well were less than 45°F and neither hazardous pressures nor hazardous fluid compositions were found.

The drilling company that conducted the work was Tonto Drilling Company from Salt Lake City, Utah. This company is one of the most widely known of the core drilling companies in the world and has drilled diamond wireline core holes in many of the western states, Canada, South America, South Africa, Indonesia, and the Philippines. They have also conducted scientific drilling, under separate earlier contracts, on the Kilauea East Rift Zone on the Big Island.

Dr. Donald Thomas was the project manager for the 1993 project and is the project manager for the present drilling effort. Should you need additional information in order to make a determination on this request, please contact him at 956-6482.

Sincerely,

Eugene S. Imai
Senior Vice President for Administration

Enclosure

c: Donald Thomas
Clyde Akita
Dear Eduardo:

Thank you for your recent assistance in reviewing the proposed Drilling Plan prepared by Don Thomas for the Hawaii Scientific Drilling Project (HSDP). I am faxing the following items for your (hopefully) FINAL review and comment:

1) My informal comments and recommendations to our Regulation Branch which were based upon our discussions and your subsequent memo. Special Conditions #3 and #4 as drafted were sent to Don Thomas and Eric Tanaka for review and comment.

2) Revisions to the Special Conditions proposed by Don Thomas.

3) Don’s proposed Perforation Plan and Long-term Disposition of the Borehole.

4) Lastly, Eric Tanaka’s questions/comments pertaining to Don’s proposed revisions and perforation plan.

As discussed with you earlier, I do not want you to spend too much time on this matter nor do I expect a response to all of the questions/comments posed by Eric. I would, however, like to get your input as to Don’s proposed BOPE-related conditions and your general thoughts regarding the more pertinent concerns raised by Eric.

Based on my limited knowledge, Don’s proposed revisions appear reasonable. With respect to cementing across the perforated section of the casing, the project will be required to comply with applicable sections of the Commission’s (water) well construction standards. (I have transmitted a copy of the pertinent section of the standards relating to Well Abandonment/Sealing for your information.) Any comments you may have with regard the proposed drilling/monitoring aspects of the project will be greatly appreciated.

Please give me a call after you have had a chance to review the information to discuss this matter further. Thank you again for your continued cooperation and assistance.

Best Regards, Dean.

Total number of pages (including Transmittal Page): 7
Please call back if not legible: (808) 587-0240
Sending Facsimile No.: (808) 587-0219
Receiving Facsimile No.: (510) 527-8164
Re: Well Construction Permit HSDP Well (Well No. 4203-16)

My comments and suggested revisions are presented below for your review and consideration:

Special Conditions

3. During drilling operations between the depth of 0 to 2,000 feet, a minimum of one (1) temperature survey shall be conducted every 200 feet. Should the drilling rate exceed 200 feet/day, a minimum of two (2) temperature surveys shall be conducted, one at the beginning and at the end of each day. If the surveys indicate an above normal increase in the temperature gradient, more frequent temperature surveys shall be conducted.

4. Should the down-hole temperature reach three times the average gradient during the drilling from 0 to 2,000 feet, Blow-Out Prevention Equipment (BOPE) shall be installed on the 13 3/8" surface casing. However, if such temperatures are encountered when drilling is near the 2,000' casing depth, the 9 5/8" casing shall be installed with the required BOPE before drilling may be allowed to continue. A shear/blind ram-type BOPE (3,000 psi) shall be installed in combination with a spool that has a valved kill and fill-up inlet to which high pressure water lines can be connected to control the well, if necessary. In no instance shall drilling commence below a depth of 2,000' without installation of the prescribed BOPE on the 9 5/8" casing.

Additional comments:

Note: We should check with Don Thomas to see if he intends to perforate the casing in the HSDP. This is not discussed in the drilling plan. Eric Tanaka has some concerns regarding the perforation of the bottom casing, and at a minimum, such perforations should be clearly set out in the drilling plan for review and approval by the CWRM.

Also, did Don submit any information re the long-term disposition/use of the well after drilling is completed? He should provide such information as part of the drilling plan. However, given our current regulatory limitations, I understand that we cannot require plugging and abandonment of the well other than for health and safety or resource degradation concerns. Therefore, if the Applicant has some planned use for the well (even if it means capping it for several years) the CWRM cannot require P/A of the well. In any event, we should know what he plans to do with the well.

Do we want to require directional surveys to locate the bottom hole location?

Was a cementing program for the casing installation submitted? Are we assured that the cementing program will comply with CWRM Well Construction Standards (and other well control considerations)?

Do we want to put in a special condition re proper management and disposal of drill cuttings, mud, and fluids, and the need for compliance with DOH regulations?

I assume DOH did not review this most recent drilling plan, therefore, shouldn't we route it to them for additional review relative to any pollution concerns related to the proposed drilling operations (e.g. drilling fluids, cement return, etc.)?
Proposed conditions:

3. During drilling operations between the depth of 0 to 2,000 ft., a minimum of one (1) temperature survey, yielding maximum downhole temperature, shall be conducted every 200 feet or every 24 hour period, whichever is shorter. If measured temperatures exceed 50°C and the temperature gradient exceeds 50°C per kilometer, then temperature measurements shall be conducted either once per 100 ft. of hole advance or once per 12 hours, whichever is shorter.

4. Should down-hole temperatures exceed 50°C and temperature gradients exceed 50°C per kilometer while drilling between 400 ft. and 2000 ft., Blow-Out Prevention Equipment (BOPE) shall be installed on the 13 3/8" casing. However, if such temperatures are encountered when drilling is near the 2000" casing depth, the 9 5/8" casing shall be installed with the required BOPE before drilling is allowed to continue. Below 2000", an annular preventer and diverter shall be installed on the 9 5/8" casing. If the temperature in the formation being drilled below 2000 ft. exceeds 50% of the temperature of boiling at the hydrostatic pressure of the formation, then the annular BOPE shall be replaced with a hydraulic double gate Type A with blind rams and pipe rams.
Perforation Plan and Long-term Disposition of the Borehole

As discussed above in the drilling plan, at the conclusion of each drilling campaign, the drill rig will be demobilized from the site and a series of tests will be performed on the hole. These tests will include downhole temperature logging that will be conducted at progressively longer time intervals to monitor temperature recovery of the formation after circulation of drilling fluids has ceased. At the conclusion of these tests, the temperature profile will be analyzed to determine the formation depths where fluid temperatures suggest the presence of changing fluid compositions. The well casings will be perforated at these depths and fluid samples will be withdrawn for chemical and isotopic analysis. The number and depths of the perforations will be determined by the characteristics of the temperature profile determined after the completion of each stage of the hole.

The long-term plans for the hole are that it will serve as a geophysical observatory in which to make both long-term as well as short-term measurements. Because the completion of the hole is several years in the future, we have not solicited detailed proposals for its use after completion of the drilling and post-drilling testing program. We expect, however, that the hole will be used for recording of seismic activity, monitoring of deformation of the volcano flanks, and possibly long-term evaluation of gravitational changes associated with changes in magma flux through the Big Island's volcanoes. The duration of these experiments could continue for several years to several decades.
FACSIMILE TRANSMITTAL PAGE

Please deliver the following pages to:

Name: Dean Nakano
Company: Water Resource Management
From: Eric Tanaka
Date: 11-5-98

Massages: Re: HSDP Well Permit Application

1. With the perforations in the water flow formation, the cement job will not be competent due to the cement going away into the formation. (If there are different separated water flows between dykes, would there be communication or co-mingling of these flows and would this be acceptable?)

2. Who will monitor the cement job when it is performed and the insure that the cement job is done correctly?

3. The BOPE Equipment will have to be tested to insure the safety of the equipment and who will conduct or witness these tests?

4. A reporting procedure should be addressed as to the reporting of of the test reports and the daily temperature logs to the commission.

5. Due to the long range plans for this well, would the University keep The Commission advised as to the activity being done with the well? (In the past, no communication has been done and no knowledge of activity taking place is known by the agency issuing the permit)

6. There should also be mentioned the end product for the well is the ultimate abandonment of the well in the future and the University should be held liable for the procedure. (Would the Commission do the abandonment if the University walks away from the well?)

7. The commission should also mention the awareness to insure the public health and safety in addressing the well during the drilling phase and also the monitoring phase.

Total no. Of pages (including transmittal pages): 1
The original document will not be sent in the mail
If you do not receive all the pages legibly, please call (808) 974-6210
Sending Fax No.: (808) 974-6222
Receiving Fax No.: (808) 587-0219
Fax copy to:
Section 3.6 Sealing the Aquifer Section of a Well

(a) Open Hole Section

After the preliminary work of abandonment and sealing has been completed, the well must be grouted as soon as possible from bottom to top beginning with the open hole section, if any, of the well.

The open hole section of the well shall be grouted with sand-cement slurry by pumping or gravity-flowing it through a 1¼-inch minimum diameter grout pipe. The bottom of the grout pipe shall be placed at the bottom of the well and flushed with potable water immediately before the introduction of the sand-cement slurry so as to minimize bridging or clogging of the pipe. The bottom of the grout pipe shall be withdrawn in stages as the open hole becomes filled, but shall extend into the slurry column while the grout is being placed so as to prevent inclusion of cavein or foreign material, bridging, dilution or separation of grout materials. The grouting of the well may be probed for effectiveness with the grout pipe or, if more practical, with a suitable probe attached to a light-weight cable.

If an interval of open hole occurs in cavernous or highly fractured formations which causes excessive loss of sand-cement slurry, No. 4 crushed aggregate (conforming to ASTM 10M) or concrete sand (conforming to ASTM C-33) may be used to fill such intervals of loss, before continuing to grout with sand-cement.

Optionally, neat cement slurry may be used to grout the open hole section, particularly if the open hole is in low permeability formations.

(b) Perforated Casing Section

After the open hole section of the well has been grouted, the perforated casing section of the well shall next be sealed with neat cement placed from bottom to top with a tremie pipe in a manner conforming to the grouting of the open hole section. However, if the perforated casing section occurs in highly fractured or cavernous formations which causes an excessive loss of neat cement slurry, a mixture of sand and cement conforming to the standards for permanent sealing may be used to fill such
Section 3.7 Sealing the Solid Casing Section of a Well

(a) Properly Grouted Wells

The solid casing section of a well with a properly grouted annular space may be sealed with sand-cement grout in one continuous operation from bottom to the ground surface. The grout must be placed with a 1\(\frac{3}{4}\)-inch minimum diameter grout pipe in a manner conforming to these Standards.

(b) Improperly Grouted Wells

If a well has no record of having a properly grouted annular space and poses a significant threat of surface contamination of an underlying potable aquifer or waste of artesian ground water, the solid casing must be perforated before grouting begins. The solid casing section shall be sealed with neat cement in one continuous operation from bottom to ground surface using a 1\(\frac{3}{4}\)-inch minimum diameter grout pipe in a manner conforming to these Standards. If an interval of the solid casing section cannot be filled after placement of a reasonable amount of neat cement slurry, sand-cement grout conforming to the standards for permanent sealing may be used to fill such interval before continuing the sealing of the blank casing section with neat cement.

Section 3.8 Special Provisions for Artesian Wells

(a) General

Many artesian wells in Hawaii are old and probably have a deteriorated, leaking casing. Consequently, such artesian wells must be abandoned and permanently sealed if found to be leaking, wasting ground water, or not in use. Artesian wells have the same purpose, objectives, and requirements of the abandonment and sealing of wells in general, but usually require more thorough investigation of the physical condition of the well and any possible artesian flow or leakage in the well before
Massages: Re: HSDP Well Permit Application

1. With the perforations in the water flow formation, the cement job will not be competent due to the cement going away into the formation. (If there are different separated water flows between dykes, there would be communication or co-mingling of these flow and would this be acceptable?)

2. Who will monitor the cement job when it is performed and the insure that the cement job is done correctly?

3. The BOPE Equipment will have to be tested to insure the safety of the equipment and who will conduct or witness these tests?

4. A reporting procedure should be addressed as to the reporting of of the test reports and the daily temperature logs to the commission.

5. Due to the long range plans for this well, would the University keep The Commission advised as to the activity being done with the well? (In the past, no communication has been done and no knowledge of activity taking place is known by the agency issuing the permit)

6. There should also be mentioned the end product for the well is the ultimate abandonment of the well in the future and the University should be held liable for the procedure. (Would the Commission do the abandonment if the University walks away from the well?)

7. The commission should also mention the awareness to insure the public health and safety in addressing the well during the drilling phase and also the monitoring phase.
Date: Monday, November 2, 1998
To: Dean Nakano
Company: DWRM
Fax Phone #: 5870219
CC:
From: Don Thomas
Subject:

Total # of Pages (including cover): 2

Memo: Dean,
The following is the proposed wording for the conditions. I'm afraid that I am out of time right now - we can talk about them when I get back, or, if I have time while I am in washington, I'll give you a call.

Regards,
Don
Proposed conditions:

3. During drilling operations between the depth of 0 to 2,000 ft., a minimum of one (1) temperature survey, yielding maximum downhole temperature, shall be conducted every 200 feet or every 24 hour period, whichever is shorter. If measured temperatures exceed 50°C and the temperature gradient exceeds 50°C per kilometer, then temperature measurements shall be conducted either once per 100 ft. of hole advance or once per 12 hours, whichever is shorter.

4. Should down-hole temperatures exceed 50°C and temperature gradients exceed 50°C per kilometer while drilling between 400 ft. and 2000 ft., Blow-Out Prevention Equipment (BOPE) shall be installed on the 13 3/8" casing. However, if such temperatures are encountered when drilling is near the 2000" casing depth, the 9 5/8" casing shall be installed with the required BOPE before drilling is allowed to continue. Below 2000", an annular preventer and diverter shall be installed on the 9 5/8" casing. If the temperature in the formation being drilled below 2000 ft. exceeds 50% of the temperature of boiling at the hydrostatic pressure of the formation, then the annular BOPE shall be replaced with a hydraulic double gate Type A with blind rams and pipe rams.
University of Hawaii at Manoa
Hawaii Institute of Geophysics and Planetology
School of Ocean and Earth Science and Technology
2525 Correa Road • Honolulu, Hawaii 96822

FAX Memo

Date: Monday, November 2, 1998
To: Dean Nakano
Company: DWRM
Fax Phone #: 5870219

Subject: Don Thomas

Memo: Dean,
Here is an expanded write-up on the well perforation plan and the long-term disposition on the deep well.
Perforation Plan and Long-term Disposition of the Borehole

As discussed above in the drilling plan, at the conclusion of each drilling campaign, the drill rig will be demobilized from the site and a series of tests will be performed on the hole. These tests will include downhole temperature logging that will be conducted at progressively longer time intervals to monitor temperature recovery of the formation after circulation of drilling fluids has ceased. At the conclusion of these tests, the temperature profile will be analyzed to determine the formation depths where fluid temperatures suggest the presence of changing fluid compositions. The well casings will be perforated at these depths and fluid samples will be withdrawn for chemical and isotopic analysis. The number and depths of the perforations will be determined by the characteristics of the temperature profile determined after the completion of each stage of the hole.

The long-term plans for the hole are that it will serve as a geophysical observatory in which to make both long-term as well as short-term measurements. Because the completion of the hole is several years in the future, we have not solicited detailed proposals for its use after completion of the drilling and post-drilling testing program. We expect, however, that the hole will be used for recording of seismic activity, monitoring of deformation of the volcano flanks, and possibly long-term evaluation of gravitational changes associated with changes in magma flux through the Big Island’s volcanoes. The duration of these experiments could continue for several years to several decades.
FACSIMILE TRANSMITTAL

To: Don Thomas
From: Ryan Imata

Company: University of Hawaii
Date: October 30, 1998

Fax Number: 956-2538
Pages Including Header: 3
Phone Number: 956-6482
Subject: Draft Permit

Notes/Comments:

Draft permit attached for your comments. Please provide an attachment to the drilling plan that talks about: 1) your intent to perforate the casing; 2) long term disposition / use of the well after well is completed.

I'll also forward additional comments as we receive them. Any questions, call me at 587-0255 or Dean at 587-0240.
REF: G:\WORK\REGULATE\TEMP\4203-16A.WCP

Mr. Eugene S. Imai
University of Hawaii
Bachman Hall
2444 Dole Street
Honolulu, Hawaii 96822

Dear Mr. Imai:

Well Construction Permit
HSDP Well (Well No. 4203-16)

Enclosed are two (2) copies of your approved Well Construction Permit for the captioned well(s) which authorizes well construction activities but excludes installation work for your permanent pump. As part of the Chairperson’s approval, the following special conditions were added and are part of your permit under Permit Condition 12:

Special Conditions

1. Attached for your information is a copy of the Department of Health’s (DOH) review comments. Please note DOH’s requirements related to discharge of effluent from well drilling and testing activities.

2. The annular space shall be in compliance with the requirements described in Section 2.6d of the Hawaii Well Construction and Pump Installation Standards.

3. During drilling operations between the depth of 0 to 2,000 feet, a minimum of one (1) temperature survey shall be conducted every 200 feet. Should the drilling rate exceed 200 feet/day, a minimum of two (2) temperature surveys shall be conducted, one at the beginning and at the end of each day. If the surveys indicate an above normal increase in the temperature gradient, more frequent temperature surveys shall be conducted.

4. Should the down-hole temperature reach three times the average gradient during the drilling from 0 to 2,000 feet, Blow-Out Prevention Equipment (BOPE) shall be installed on the 13 3/8" surface casing. However, if such temperatures are encountered when drilling is near the 2,000' casing depth, the 9 5/8” casing shall be installed with the required BOPE before drilling may be allowed to continue. A shear/blind ram-type BOPE (3,000 psi) shall be installed in combination with a spool that has a valved kill and fill-up inlet to which high pressure water lines can be connected to control the well, if necessary. In no instance shall drilling commence below a depth of 2,000’ without installation of the prescribed BOPE on the 9 5/8” casing.

To validate your permit, please sign and have the contractor sign both permit originals and return one for our files. Also, copies of the aquifer pump test worksheet and the well completion report form are enclosed for your use. Please provide all the information in this packet to your well drilling contractor.

IMPORTANT - The permittee is responsible for all conditions of the permit. This includes ensuring that the well construction contractor, or other party who constructs the well(s), submits a completed Part I of the Well Completion Report form (enclosed) within
sixty (60) days after the well construction work is completed. Be advised that you may be subject to fines of up to $1000 per day for any violations of your permit conditions.

If you have any questions, please call the Commission staff at 587-0255.

Aloha,

MICHAEL D. WILSON
Chairperson

Enclosures
WELL CONSTRUCTION PERMIT

HSDP Well, Well No. 4203-16

In accordance with Department of Land and Natural Resources, Commission on Water Resource Management’s Administrative Rules, Section 13-168, entitled "Water Use, Wells, and Stream Diversion Works", this document permits the construction and testing of HSDP Well (Well No. 4203-16) at Hilo International Airport, Hawaii, TMK 2-1-12: 9, subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97) which include but are not limited to the following conditions:

1. The Chairperson of the Commission on Water Resource Management (Commission), P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work authorized by this permit commences.

2. The well construction permit shall be for construction and testing of the well only. A minimum one-inch diameter monitor tube shall be permanently installed, in a manner acceptable to the Chairperson, to accurately record water levels. The permittee shall coordinate with the Chairperson and conduct a pumping test in accordance with the Standards (a pump testing worksheet is attached). The permittee shall submit to the Chairperson the test results as a basis for supporting an application to install a permanent pump and withdraw water for use. No permanent pump may be installed until a pump installation permit is approved and issued by the Chairperson.

3. In basal ground water, the depth of the well may not exceed one-fourth (1/4) of the theoretical thickness (41 times initial head) of the basal ground water unless otherwise authorized by the Chairperson.

4. The permittee shall incorporate mitigation measures to prevent construction debris from entering the aquatic environment, to schedule work to avoid periods of high rainfall, and to revegetate any cleared areas as soon as possible.

5. In the event that subsurface cultural remains such as artifacts, burials or concentrations of shells or charcoal are encountered during construction, the permittee shall stop work and contact the Department’s Historic Preservation Division (587-0045) immediately.

6. The proposed well construction shall not adversely affect existing or future legal uses of water in the area, including any surface water or established instream flow standards. This permit or the authorization to construct the well shall not constitute a determination of correlative water rights.

7. The following shall be submitted to the Chairperson within sixty (60) days after completion of work:
   b. Elevation (referenced to mean sea level, msl) survey by a Hawaii-licensed surveyor.
   c. As-built sectional drawing of the well.
   d. Plot plan and map showing the exact location of the well.
   e. Complete pumping test records, including time, pumping rate, drawdown, chloride content, and other data.

8. The permittee shall comply with all applicable laws, rules, and ordinances; non-compliance may be grounds for revocation of this permit.

9. The well construction permit application is incorporated into this permit by reference and is subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97).

10. The permit may be revoked if work is not started within six (6) months after the date of approval or if work is suspended or abandoned for six (6) months, unless otherwise specified. The work proposed in the well construction permit application shall be completed within two (2) years from the date of permit approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than three (3) months prior to the date the permit expires. If the commencement date is not met, the Commission may revoke the permit after giving the permittee notice of the proposed action and an opportunity to be heard.

11. If the well is not to be used it must be properly capped. If the well is to be abandoned then the permittee must apply for a well abandonment permit in accordance with §13-168-12(f) prior to any well sealing or plugging work.

12. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

Date of Approval: June 24, 1998
Expiration Date: June 24, 2000

MICHAEL D. WILSON, Chairperson
Commission on Water Resource Management

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $1000 per day.

Permittee’s Signature: ___________________________ Date: __________

Printed Name: ___________________________ Firm or Title: ___________________________

Driller’s Signature: ___________________________ License #: __________ Date: __________

Printed Name: ___________________________ Firm or Title: ___________________________

Please sign both copies of this permit, return one to the Chairperson, and retain the other for your records.

Attachment: C:
   USGS
   Department of Health’s Safe Drinking Water, Wastewater, and Clean Water Branches
   Hawaii Department of Water Supply
   Department of Transportation, Airports Division
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Incomplete

Need James signature. I thought he said he was
still working on this.

Susan - please route to Lead Div. letter to
app. dept. of Dept. app. to file.

Also, no maps +
Contractor exemption.

How does this relate to 4203. No & 181? I changed
only 2 holes -> one more 3? 2

(this is the well permitted by

Munobu)
Mr. Donald Thomas
HIGP
2525 Correa Road
Honolulu, HI 96822

Dear Mr. Thomas:

After-the-Fact Well Construction Permit Application for HSDP Pilot Hole

We have received your after-the-fact well construction permit application for the HSDP Pilot Hole Well. However, your application is incomplete. Matters which must be addressed before we accept your application as complete are as follows:

1. Please submit certification from Department of Commerce and Consumer Affairs that driller is exempt from the licensing requirements.

2. Please attach the appropriate maps (USGS and Tax Map) as requested on the application form.

3. Although you have not obtained the landowner's signature, we will route your application to the Land Division for signature.

Upon receipt of the above information, we will accept your application as complete and you can then expect your application to be processed within ninety (90) days.

If you have any questions about your permit application, please contact Mr. Ryan Imata of the Commission staff at 587-0255.

Sincerely,

TIMOTHY E. JOHNS
Deputy Director

RI:ss
TO: Mr. Dean Uchida, Administrator  
Land Division

FROM: Timothy E. Johns, Deputy Director  
Commission on Water Resource Management

SUBJECT: Request for Chairperson's Signature as Landowner

The attached permit application entails the use of State-owned land and, accordingly, requires the signature of the Chairperson as the landowner. Here, we are requesting your help in affirming the State's ownership of the property and, thereafter, routing the application to the Chairperson for his signature. (We have enclosed the appropriate transmittal memo that contains the affirmation statement.)

Please note that the Chairperson's signature on the permit application completes the application and allows it to be accepted for processing by the Commission. The signature neither represents an endorsement of the applicant's proposal nor an approval for the use of State land; both approvals would be sought by the applicant under separate actions later.

Please inform us if the proposed project is in the Conservation District and, if so, whether the requirements of Chapter 343 have been met.

Lastly, please inform us of the contact person at Land Division who is responsible for transmitting the attached original applications to the Chairperson's office.

LN:ss  
Attachment
**APPLICATION FOR PERMIT**

**☐ Well Construction**  **or  ☐ Pump Installation**

**Instructions:** Please print in ink or type and send completed application with attachments to the Commission on Water Resource Management, P.O. Box 621, Honolulu, Hawaii 96809. Application must be accompanied by a non-refundable filing fee of $25.00 payable to the Dept. of Land and Natural Resources. The Commission may not accept incomplete applications. For assistance, call the Regulation Branch at 587-2325.

1. **APPLICANT:** (may be a, b, or c, but all must be filled in)
   - **(a) WELL OWNER**
     - **Firm/Name:** University of Hawaii
     - **Contact Person:** Donald Thomas
     - **Phone:** 956-6822
     - **Address:** HGF; 2325 Correa Road
     - **City:** Honolulu, HI 96822
   - **(b) LANDOWNER**
     - **Firm/Name:** DLNR Land Division
     - **Contractor's C-67 License No.:**
     - **Address:** P.O. Box 25138, Salt Lake City, Utah 84120-0128
   - **(c) CONTRACTOR**
     - **Firm/Name:** Tonto Drilling Co.
     - **Phone:**
     - **Address:** P.O. Box 25138, Salt Lake City, Utah 84120-0128

2. **WELL LOCATION/NAME:** HSDP Pilot Hole
   - **Island:** Hawaii
   - **Address:** see attached
   - **Tax Map Key:** 2-1-09-41

3. **(a) PROPOSED WORK:**
   - Drill New Well
   - Modify Existing Well
   - Redrill
   - Install New Pump
   - Modify Pump
   - Replace Pump
   - Deepen
   - * Abandon/Seal

4. **PROPOSED PUMP INFORMATION:**
   - **Rated Pump Capacity:** None
     - **gallons per minute**

5. **PROPOSED USE:**
   - Municipal (including hotels, stores, etc.)
   - Domestic (individual, noncommercial water use)
   - Irrigation (crop)
   - Other (explain) Research

6. **PROPOSED AMOUNT OF WITHDRAWAL:** None
   - **gallons per day**

7. **PENDING ACTIONS:**
   - CDUA
   - SMA
   - EIS
   - EA
   - None
   - Other (explain)

8. **REMARKS, EXPLANATIONS:**
   - **This well was drilled for scientific research purposes under a permit issued by Division of Water & Land Development. This is an after-the-fact permit application to bring the well into compliance with:**

---

**NOTE:** Signing below indicates that the applicant understands that, if the permit requested is granted by the Commission on Water Resource Management, the proposed work is to be completed within two (2) years of the approval date. In addition, the contractor shall submit to the Commission a well completion report, well abandonment report, or both, within 30 days after the completion date of the permitted work. The applicant also understands that monthly water use data shall be submitted to the Commission. The applicant further understands that approval of the proposed permit shall constitute a determination of correlative water rights and shall not guarantee the pump capacity or future use up to the permitted pump capacity.

---

**Well Owner:** University of Hawaii

**Landowner:**

**Contractor:**

**Signature:**

**Date:**

---

**For Official Use Only:**

**Date Received:**

**Date Accepted:**

**Field Checked By:**

**Date:**

---

**Longitude:**

**Aquifer System Name:**

**State Well No.:**

---

6/24/92 WCR For
9. PROPOSED WELL SECTION

Elevation at top of casing: __________ ft., msl.

Ground Elevation: __________ ft., msl

Cement Grout: __________ ft.

7" conductor casing
PQ Drill Rod (4 5/8") to 214'
HQ Drill Rod (3 1/2") to 2348'

Rock Packing: __________ ft.

Solid Casing:
Material: steel
Length: __________ ft.
Diameter: __________ in.
Wall thickness: __________ in.

NQ Drill Rod (2 3/4") to 3442'

Hole Diameter: __________ in.

Total Depth: 3464 ft.

Casing of the well has been perforated at the following depths to allow fluid sampling and analysis:
230'; 551'; 750'; 1070'; 1340'; 1869'

*Approximate elevation at time of filing application. Ground elevation above mean sea level (msl) by a surveyor licensed by the State must be submitted at start of construction. Final elevations of well components shall be submitted in the well completion/well abandonment reports.
To: Ryan  
Cc: Roy  
Fr: Dean  
Re: Well Construction Permit HSDP Well (Well No. 4203-16)

My comments and suggested revisions are presented below for your review and consideration:

**Special Conditions**

3. During drilling operations between the depth of 0 to 2,000 feet, a minimum of one (1) temperature survey shall be conducted every 200 feet. Should the drilling rate exceed 200 feet/day, a minimum of two (2) temperature surveys shall be conducted, one at the beginning and at the end of each day. If the surveys indicate an above normal increase in the temperature gradient, more frequent temperature surveys shall be conducted.

4. Should the down-hole temperature reach three times the average gradient during the drilling from 0 to 2,000 feet, Blow-Out Prevention Equipment (BOPE) shall be installed on the 13 3/8" surface casing. However, if such temperatures are encountered when drilling is near the 2,000' casing depth, the 9 5/8" casing shall be installed with the required BOPE before drilling may be allowed to continue. A shear/blind ram-type BOPE (3,000 psi) shall be installed in combination with a spool that has a valved kill and fill-up inlet to which high pressure water lines can be connected to control the well, if necessary. In no instance shall drilling commence below a depth of 2,000' without installation of the prescribed BOPE on the 9 5/8" casing.

**Additional comments:**

Note: We should check with Don Thomas to see if he intends to perforate the casing in the HSDP. This is not discussed in the drilling plan. Eric Tanaka has some concerns regarding the perforation of the bottom casing, and at a minimum, such perforations should be clearly set out in the drilling plan for review and approval by the CWRM.

Also, did Don submit any information re the long-term disposition/use of the well after drilling is completed? He should provide such information as part of the drilling plan. However, given our current regulatory limitations, I understand that we cannot require plugging and abandonment of the well other than for health and safety or resource degradation concerns. Therefore, if the Applicant has some planned use for the well (even if it means capping it for several years) the CWRM cannot require P/A of the well. In any event, we should know what he plans to do with the well.

Do we want to require directional surveys to locate the bottom hole location?

Was a cementing program for the casing installation submitted? Are we assured that the cementing program will comply with CWRM Well Construction Standards (and other well control considerations)?

Do we want to put in a special condition re proper management and disposal of drill cuttings, mud, and fluids, and the need for compliance with DOH regulations?

I assume DOH did not review this most recent drilling plan, therefore, shouldn't we route it to them for additional review relative to any pollution concerns related to the proposed drilling operations (e.g. drilling fluids, cement return, etc.)?
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- Will completion report form
- Is B on aware of the special conditions?
- Spell out other for "kill line"
- Shear/blind rain combinations

[Initial Notes]

[Initial Notes]

[Initial Notes]
Mr. Eugene S. Imai
University of Hawaii
Bachman Hall
2444 Dole Street
Honolulu, Hawaii 96822

Dear Mr. Imai:

Well Construction Permit
HSDP Well (Well No. 4203-16)

Enclosed are two (2) copies of your approved Well Construction Permit for the captioned well(s) which authorizes well construction activities but excludes installation work for your permanent pump. As part of the Chairperson's approval, the following special conditions were added and are part of your permit under Permit Condition 12:

Special Conditions

1. Attached for your information is a copy of the Department of Health's (DOH) review comments. Please note DOH's requirements related to discharge of effluent from well drilling and testing activities.

2. The annular space shall be in compliance with the requirements described in Section 2.6d of the Hawaii Well Construction and Pump Installation Standards.

3. For depths between 0 and 2000 feet, at least one (1) temperature survey shall be conducted every 200'. Alternatively, temperature surveys may be conducted at the beginning and end of each day. If the survey indicates an above normal rise in the temperature gradient, more frequent temperature runs shall be conducted. In the event that the temperature reaches three times the average gradient, BOPE shall be installed on 13 3/8" casing, or if near the 2000' casing depth, a blind ram (3000 psi) and 9 5/8" casing shall be installed.

To validate your permit, please sign and have the contractor sign both permit originals and return one for our files. Also, copies of the aquifer pump test worksheet and the well completion report form are enclosed for your use. Please provide all the information in this packet to your well drilling contractor.

IMPORTANT - The well owner is responsible for all conditions of the permit. This includes ensuring that the well construction contractor, or other party who constructs the well(s), submits a completed Part I of the Well Completion Report form (enclosed) within sixty (60) days after the well construction work is completed. Be advised that you may be subject to fines of up to $1000 per day for any violations of your permit conditions.

If you have any questions, please call the Commission staff at 587-0255.

Aloha,
MICHAEL D. WILSON
Chairperson

Enclosures
made using the core tube logger on a daily basis. This translates to a measurement being made at intervals of no greater than about every 200' in the shallow interval of the hole; as the depth increases and rate of penetration decreases, the maximum interval of measurement will decrease. If the rate of temperature increase approaches a level that suggests that additional well control measures would be advised, a BOPE stack will be installed on the wellhead. The precise temperature at which this would be considered necessary is difficult to predict since the level of risk of well control problems is related to the temperature, pressure and the formation permeability. As the hydrostatic load on the formation increases, the temperature to which the formation fluid can rise without boiling progressively increases. Similarly, if the drilling conditions indicate that loss of circulation fluids is highly likely, then the margin of safety required will need to be increased. Given these considerations, we will retain the services of a geothermal drilling engineer to advise us as to how best to proceed with the installation of a BOPE if formation temperatures reach more than 50% of boiling temperatures at the local hydrostatic head.

- If survey indicates above normal rise in temp. gradient, run more frequent temp. surveys. When temp. gradient reaches 3x avg. gradient, install BOPE on 15 5/8" casing or if near 2000' casing depth, install 9 5/8" casing and blind ram (3000 psi).

  For every 200' drilled, make at least (1) temp. survey run.
  If >200' drilled, make (2) temp. surveys (one at start/end of day)
As you requested in your fax of 19 October, 1998, we have reviewed the Drilling Plan presented by the University of Hawaii for the Hawaii Scientific Drilling Project and would like to offer the following comments:

- We have reviewed the discussion presented by the University regarding the probability of encountering elevated temperatures or pressures during the drilling of the deep hole. In our opinion, the arguments presented are reasonable. However, we do not feel that it is possible to completely rule out the possibility, remote though it may be, of encountering high-temperature hydrothermal conditions at depths that have not yet been investigated directly by drilling in the area. Such direct investigation is limited to the 3,500-foot hole drilled at Hilo Harbor in 1993.

- The Commission may wish to consider the possible effects of setting a precedent in permitting such a deep well to be drilled without the routine use of blowout prevention equipment. We have no doubt that the University is serious in its intention to carefully monitor bottomhole temperatures during drilling, and to suspend the drilling operations if the temperatures increase beyond a certain limit. However, others might expect or demand relaxed requirements in the future unless a clear policy is established.

- As presented by the University, the plan for monitoring downhole temperature several times a day with an electronic logging instrument is acceptable. This instrument will have the capability of measuring the temperature each time the core barrel is retrieved and we see no reason why the University would have any problem in increasing the frequency of measurements whenever the circumstances so dictate.

As presented by the University, the plan for monitoring downhole temperature several times a day with an electronic logging instrument is acceptable. This instrument will have the capability of measuring the temperature each time the core barrel is retrieved and we see no reason why the University would have any problem in increasing the frequency of measurements whenever the circumstances so dictate.

avq gradient

Ex Temp - install BOP equip.
• We did not find any serious problems with the drilling program as presented, assuming the rig that is intended to be used to conduct the job will have the adequate capacity to open the hole as shown on their plan. Nor do we find any problem with installing the BOP equipment after the 9-5/8-inch casing has been cemented at approximately 2,000 feet. We agree with the University's argument that if temperatures in the nearby hole were very low to a depth of 3,500 feet, the possibility of encountering a much different environment within a distance of one mile is extremely remote.

• However, the University's plan calls for the installation of a 3,000 psi annular preventer and a diverter on the wellhead. In our opinion this would not be very effective in controlling a gas, hot water or steam kick. New subsurface conditions will first be encountered while coring (rather than during the second, hole-opening pass), and therefore if a blowout were to occur it would probably be while coring rather than while rotary drilling. Coring will take place using drilling rods inside a temporary 5-inch casing, and it is unlikely that fluids from the bottom of the well could move in an uncontrolled manner through the small annulus between casing and rods; it is only this annulus that could be closed off using the annular preventer.

• Experience shows that blowouts in coring operations are most likely to occur from inside the drilling rods, which provide a conduit to the surface because they are open to the bottom of the hole, and because a swabbing effect is created every time the core barrel is retrieved, thus favoring the unloading of the well and creating the conditions for an uncontrolled flow.

• Therefore, in our opinion it would be more useful to install a ram-type blowout preventer, which could shear off the rods in the event of an uncontrolled flow coming from inside the pipe. Because it is not intended that this hole produce any fluids at the surface, the proposed diverting device is not needed. Rather, the BOP should be installed above a spool that has valved kill and fill-up inlets, to which high pressure water lines would be connected at all times. The inlets would allow the injection of cold water to quench and gain back the control of the well, if necessary.

• We agree with the Commission's concern about the University's lack of solid and fluid disposal plan during the drilling of the upper part of the hole. It is true that only a small amount of fine sand will return to the surface while coring, but during the hole opening operations a significant amount of cuttings will be generated, and it should not be expected that fractures in zones of circulation loss will necessarily take all the cuttings and fluid, as the occurrence of circulation losses cannot normally be inferred reliably from other wells over significant distances. Therefore, an appropriate mud pit and cuttings disposal plan should be implemented beginning with the initial phases of drilling this well.
We hope that the above comments will help you in making your recommendation to the Commission. Please do not hesitate to contact us again if you need further clarifications or if you would like us to address any of these items more specifically.

Best regards.
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We hope that the above comments will help you in making your recommendation to the Commission. Please do not hesitate to contact us again if you need further clarifications or if you would like us to address any of these items more specifically.

Best regards.
## Hawaii Scientific Drilling Project

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# Hawaii Scientific Drilling Project

## DIS: Data-Report

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BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

FACSIMILE TRANSMITTAL

To: Eric Tanaka
Company: Land Division
Fax Number: 974-6222
Phone Number: 974-6210

From: Ryan Imata
Date: September 24, 1998
Pages Including Header: 2

Subject: UH HSDP Wells

Notes/Comments:

Eric

Don Thomas sent in this drilling plan and other related items. Can you review this for me? Give me a call if you have any questions.

Mahalo
Ryan

---

Glenn-

Can you please review?

Ryan - looks good. His analysis looks good. His maps point me the Thx

to Mr. His major points is the to

just experience all the to

proximity is the we can

Please activity

Ryan
We offer the following regarding the questions of the potential for thermal activity or over-pressured gas formations in the Hawaii Scientific Drilling Project deep hole that were raised in your letter of September 4, 1998. We will address these concerns on two levels. The first is our assessment of the likelihood that geothermal conditions will be encountered on the basis of geological and geophysical evidence. Secondly we will discuss the planned drilling procedures that will be employed to ensure that we will be able to deal with them in a safe manner in the unlikely event that we do encounter pressurized zones.

Stratigraphic Column and Geologic Conditions at the Planned Drill Site
In order to address the question of the probability of encountering elevated temperatures in our deep drill hole, it is necessary to go back to “first principles” of Hawaiian geology. It is widely recognized that two modes of lava emplacement contribute to the construction of the volcanic edifice: lava flow discharge (extrusive activity) and intrusion of magma into the pre-existing edifice (intrusive activity). The former is characterized by the discharge of submarine or subaerial lava flows from an eruptive vent. The extrusive lava flows travel downslope from the eruptive vent and typically range in thickness from a few centimeters to a few meters. Extrusive flows may make up as little as 40% to as much as 80% of a Hawaiian shield volcano. Intrusive activity is associated with the emplacement of a dike or sill within the pre-existing volcanic pile formed from prior extrusive flows and intrusive bodies. Intrusive bodies typically range in width/thickness from a few centimeters to a few meters and are thought to range in depth of emplacement from the surface (e.g. a remnant eruptive vent) to as deep as the base of the volcanic pile. The emplacement of intrusives in Hawaiian volcanoes is not a random process but is governed by gravitational stresses that are present within each volcano. In the great majority of cases, intrusions are confined to the summit calderas (which overlie the conduit through which the magma rises into the volcanic pile) and two or more rift systems that radiate out from the summit magma chamber. The distribution of the rift zones is dictated by the direction of least principal (horizontal) stress in the volcano. As a result, these systems typically form parallel to the unbuttressed seaward flank of the growing volcanic system: a type example would be the Kilauea East Rift Zone.

The rate and mechanism of cooling of extrusives and intrusives is distinctly different. Whereas the extrusive lava flows generally cool very rapidly, the cooling rate for intrusives is much more variable. Because the extrusive flows are exposed directly to the air (or ocean water) they will cool in a matter of hours to a few days. In rare cases, such as small constructional shields (e.g. Mauna Ulu) or lava lakes (Kilauea Iki), cooling may occur over periods of, at most, a few decades. The cooling rate for intrusive bodies is governed by several factors: the thickness of the intrusion; the temperature of the rock into which the magma is intruded (the “country rock”); the permeability of the country rock; and the availability of water in the country rock. In a situation where an intrusion occurs into older extrusive flows above the local water table, it may take decades to possibly centuries for the intrusive to cool to ambient temperature. This is because rock is a poor conductor (or a good insulator) of heat and the absence of large quantities of water reduces the rate of heat loss due to steam formation or convective movement of water. An intrusive body injected into permeable, water saturated rock, may cool much...
more quickly since boiling of the groundwater, or convective circulation of the groundwater, can carry heat away from the intrusive much more quickly. If magma is intruded into country rock that has a low permeability and is already hot (such as into a rift zone) the cooling process occurs much more slowly. As a result of the modest amount of intrusive lavas making up Hawaiian volcanoes, as well as their confinement to rift zones, the locations in which high temperature hydrothermal systems are believed to exist are relatively few in number and small in size relative to the mass of the volcanic systems. Exploration for high temperature hydrothermal systems within the state supports this belief: extensive geophysical and geochemical exploration through out the state has identified only the Kilauea East and Southwest Rift Zones as having a high potential for high temperature hydrothermal systems and the Mauna Loa East and Southwest Rift Zones as having a moderate potential for such systems.

As discussed in the Environmental Assessment for the HSDP, the primary scientific objective of the drilling program is to recover an extended sequence of (stratigraphically oriented) samples from the lava flows of an ocean island volcano and to conduct detailed geochemical analyses of these samples. One of the prime criteria for site selection was to avoid intrusive bodies - since they are not stratigraphically emplaced according to their age - and, to the degree possible, avoid the geochemical effects of hydrothermal alteration of the chemical compositions of the lava flows. As seen in the Kilauea East Rift Zone, hydrothermal alteration can almost completely replace the original lava flows and intrusives with clays and secondary minerals that bear little resemblance to the original lava compositions. Hence, one of the most important criteria for selection of the Hilo drill site was the avoidance of the rift system of any volcano. The Hilo site is located about equidistant from the Mauna Kea east rift zone to the north and (to the extent we are able to recognize it) the Mauna Loa rift system to the south. The geophysical data used for guidance in the site selection included both gravity data - which shows rift systems as gravitational highs due to the higher density of the intrusives - and aeromagnetic surveys which show distinct anomalies associated with the Kilauea East Rift Zone.

The pilot drill hole that was completed near the Hilo Harbor in 1993 clearly demonstrates that our effort to avoid recent intrusive or rift zone activity was successful. The temperature gradient in the hole, over the entire depth drilled, showed a temperature gradient of minus 15°C per kilometer depth (i.e. the temperature at the bottom of the hole was 15°C colder than the top). This temperature gradient was driven by circulation of cold deep ocean water through the Mauna Kea (extrusive) lavas. Equally significant was the fact that there was no evidence of any hydrothermal circulation of deep ocean water that would have been expected if a thermal source exists at depth below the drilling site. Had there been a hydrothermal system at intermediate depth we would have expected to see a plume of warm water discharging “across” the hole at some depth. This phenomenon is evident in the Kilauea East Rift Zone where most shallow wells show a layer of warm water at, or near, the surface of the water table. The only feature found in the pilot hole that resembles such a plume was the temperature variation that we found associated with the freshwater outflow at ~300 m depth; analysis of this water has shown that it is derived from fresh recharge that enters Mauna Kea at an elevation of about 2000
m above sea level. The temperature of this water is approximately 15 °C and is not significantly warmer than its average temperature of entry into the groundwater system. Hence, we have no evidence that there is a significant elevation of temperature at intermediate depths below the 1 km depth drilled for the pilot hole.

It might be argued that a buried rift system could be present at some depth below the bottom of the pilot hole and that it may not be discharging sufficient amounts of fluids to be visible in the temperature profile of the pilot hole. We don't believe that this is likely for several reasons. The first is that this rift system would need to be very small or very deep in order to be undetectable to both gravity and aeromagnetic surveys. Secondly, it would have to be a very old rift system. As noted above, the location of intrusive emplacement is governed by gravitational stresses; hence, significant intrusive activity beneath our present site is unlikely to have occurred with a younger volcano of significant size present at Mauna Loa's current location. If an earlier rift system had formed on the south flank of Mauna Kea, it would not have remained active after Mauna Loa built up to a size where it could act as a buttress for this side of Mauna Kea and this is likely have occurred as long as 500,000 years ago. Having such a great age would make it extremely unlikely that temperatures and pressures within this fossil system would approach those found in the Kilauea East Rift Zone, where intrusive events occur at frequencies of years to decades, and almost certainly would not be high enough to pose a threat to the surface equipment.

Finally, there is the possibility that conductive heat loss around the now dormant magma chamber of Mauna Kea could be heating the surrounding rocks without there being substantial convective heat transfer. We don't believe that this type of condition has a significant probability of impacting our operations for two reasons. The first is that we have selected a site that is approximately 45 km from the center of Mauna Kea. The magma chamber of Kilauea and Mauna Loa are estimated to be no more than a few kilometers in diameter on the basis of modelling the inflation/deflation process associated with past eruptive episodes. If we assume even a 10 km diameter magma chamber/dike complex beneath Mauna Kea's summit, then our site is still located about 40 km (radially) away from the edge of the magma chamber. The likelihood of conductive heating of the extrusive material to significant temperatures at this distance from the magma chamber is believed to be remote at best. Further, even if some heating is occurring, the temperature rise would be sufficiently diffuse that we would expect (once we entered into a low-permeability conductive formation) to see a very gradual temperature rise with increasing depth. Finally, it should also be recognized that a low-permeability conductive temperature regime would reduce the likelihood of pressure control problems during drilling. This is because well "kicks" in geothermal environments frequently result from loss of drilling fluids out of the well (into highly permeable formations) and loss of the hydrostatic head that allows the driller to maintain control of the steam pressure in the well. This was the mechanism of the venting episode of the KS-8 well: a highly permeable fracture was encountered, a substantial amount of mud was lost from the wellbore and was followed by steam entry and pressurization of the hole that was only partly filled with drilling fluids.
In summary, our assessment of the likelihood of encountering high formation temperatures at the present drilling location that are the result of volcanic (intrusive) heat from Mauna Kea volcano is so remote as to be considered nearly impossible. This does not necessarily mean that we will not encounter higher temperatures at depth than those already found in the pilot hole. It is recognized that radioactive decay of naturally occurring uranium, thorium, and potassium present in Hawaiian lavas can generate small amounts of heat which could increase formation temperatures with depth. However, the rate of temperature increase with depth will be a direct function of the rate of fluid circulation (and heat loss) within the volcanic pile. The pilot hole demonstrated that high rates of fluid circulation occur to depths of at least 1 km within Mauna Kea. Subaerial lavas may extend to as deep as 2 km and are expected to be underlain by an interval of fragmental material of unknown thickness which may, in turn be underlain by pillow lavas. Because of the high permeability of the subaerial lavas and the underlying fragmental material, any radiogenic heat accumulation will be accompanied by increased fluxes of cold seawater convecting through the system. This latter process will limit both the rate of temperature increase with depth as well as the maximum temperatures that are likely to be attained. Within the highly permeable formations, we do not expect to see temperatures more than a few degrees above the ambient seawater temperature of about 4 °C. As drilling penetrates to greater depths, we may see a progressive deterioration of permeability which can be expected to be accompanied by a gradual rise in temperature. Temperature measurements made in drillholes on the ocean floor have shown that the geothermal gradient in basaltic crust rise at a rate of about 24°C per kilometer depth. At this rate, bottom hole temperatures at a depth of 3300 m (the maximum depth expected during our first drilling campaign) would be 65°C and at 4.5 km, the final depth of the hole, temperatures may reach 97°C. Neither of these expected temperatures will pose a serious threat of blow-out or un-controlled discharge of fluids.

The potential of gas discharges, or pockets of elevated gas or fluid pressures, is related to the issue of temperature. The geology of continental environments allows the formation of high pressure formations (CO2, methane, or deposits of natural gases associated with oil fields) that are associated with sedimentary deposits of organic material. These geologic structures (sedimentary basins) are not present in Hawaiian volcanoes; this will preclude the accumulation of pressurized natural gas deposits. The only exception to this is in the case of high pressure steam and geothermal gases where the primary vapor present is saturated steam. In the absence of high geothermal temperatures, it is not considered possible for a substantial accumulation of gases to develop - and maintain - significant pressures above local hydrostatic. Hence, this is not believed to be a significant consideration in the drilling of the present research well.
Well Control Strategies

In spite of the low temperature gradient that is projected for this borehole, we are drilling in an area where no holes of similar depth have yet been drilled. Hence, we have designed our drilling program so that any hazardous contingency, within reason, can be safely dealt with and any possible adverse consequences to the equipment, personnel, and site, can be minimized. As a matter of simple prudence, we have included procedures and equipment designs that will enable us to maintain control of the well under any reasonably expected conditions. Included as part of the drilling protocol will be periodic acquisition of downhole temperatures during the core drilling process. Our on-site drilling equipment will include a core-tube logging instrument that will allow us to measure downhole temperatures during the coring process. The instrument will be sent to the bottom of the hole during one (or more, as conditions dictate) coring run each day and will record the fluid temperature immediately above the core bit as that run’s core is being cut. When the core-tube is retrieved, the temperature record can be downloaded to a laptop computer and will enable us to estimate the formation temperature at the depth of that core run. At each casing depth, we will conduct a wireline log of the formation temperatures that will be compared to the temperature estimates derived from the core-tube logger; from this we will be able to maintain an updated correction factor to apply to the next interval’s core-tube temperature measurements. A record of the formation temperatures will be maintained by the drilling engineer; any unusual deviations or excursions can be considered by him in his planning for each day’s drilling activities. If temperatures are encountered that are significantly higher than anticipated, we will suspend drilling to allow a downhole wireline temperature log to be run inside the core tubing string to confirm the formation temperatures. If the temperatures are sufficiently high to warrant additional pressure control precautions, it will be possible to pull the tubing string out the hole and add whatever well control equipment that is deemed necessary.

The well design will be as shown in the attached figure. Conductor casing will be installed at the surface down to a depth of 30'; 13 3/8” USS-H40 surface casing will be installed to a depth of 400'; 9 5/8” J-55 casing will be installed to a depth of 2000'; 7” K-55 casing will be installed to a depth of 6000'; and 5” L-80 casing will be installed to 11,000’. It should be understood, however, that these are target depths: drilling conditions and hole stability will ultimately have to be considered when the casing program is executed. During coring operations, a 5” liner will be installed within each of the larger casing strings to stabilize the rotating core rod and to allow us to better monitor fluid returns (when they do occur). We believe that this casing program will be sufficient to handle any temperature and pressure that we are likely to encounter in the HSDP borehole.

Our prior experience drilling the pilot hole suggests that we will not need pressure control equipment down to a depth of at least 3500’: the earlier drilling demonstrated that formation temperatures were colder than surface ambient and that artesian pressures in the freshwater aquifers were no more than a few pounds per square inch. When the 9 5/8 casing is installed to a depth of 2000’ we will install a 3000 psi annular preventer and a diverter on the wellhead. As noted above, downhole temperature measurements will be
made using the core tube logger on a daily basis. This translates to a measurement being made at intervals of no greater than about every 200' in the shallow interval of the hole; as the depth increases and rate of penetration decreases, the maximum interval of measurement will decrease. If the rate of temperature increase approaches a level that suggests that additional well control measures would be advised, a BOPE stack will be installed on the wellhead. The precise temperature at which this would be considered necessary is difficult to predict since the level of risk of well control problems is related to the temperature, pressure and the formation permeability. As the hydrostatic load on the formation increases, the temperature to which the formation fluid can rise without boiling progressively increases. Similarly, if the drilling conditions indicate that loss of circulation fluids is highly likely, then the margin of safety required will need to be increased. Given these considerations, we will retain the services of a geothermal drilling engineer to advise us as to how best to proceed with the installation of a BOPE if formation temperatures reach more than 50% of boiling temperatures at the local hydrostatic head.
Disposal of drilling fluids and solids

Your letter of September 4 references disposal of large amounts of drill cuttings. It appears that there is a misunderstanding regarding the nature of the drilling program as well as an incomplete understanding of the formation conditions that we are likely to encounter. We will address each separately in an effort to explain why we do not anticipate having large quantities of cuttings material from the present well.

Two types of drilling technology will be applied in our project. As has been indicated in a number of documents describing the project, the objective of the program is to recover core material from the well. While we are using the core drilling technology, we will be grinding a cylindrical hole using a narrow-kerf coring bit. Most of the material removed from the hole during the core operations will be in the form of core; the "cuttings" generated will be a small fraction of the volume of the hole and will be in the form of a fine power rather than cuttings. In the upper part of the hole, we will alternately collect core and then re-enter the hole using a conventional rotary bit or a hole-opening bit to enlarge the diameter of the hole to allow us to set a casing string. As we progress down the hole, the difference in diameter between the coring process and the hole opening exercise will decrease. The first 400' will be cored with a 3.85" diameter bit and the hole will be opened to 17.5"; from 400' to 2000' the 3.85 diameter core hole will be opened to 12.25"; from 2000' to 6000' the 3.85" core hole will be opened to 8.75"; and from 6000' to 11,000' the 3.85" hole will be opened to 6.125"; below this depth we do not intend to conduct hole opening drilling.

Although the relative hole sizes of the cored and cased hole sections will impact the amount of cuttings generated by the operations, the most important factor governing the amount of material accumulated at the surface will be the formation permeability. As was demonstrated by the pilot hole, the first 3,500' of drilling will be in subaerial basalts; we expect to be in subaerial formations for at least another 1000' and possibly as much as another 2500'. Because these basalts are so permeable, the drilling fluids circulated into the hole will almost certainly be lost to the formation as long as any portion of the hole is open to subaerial flows. Hence, during both coring and hole opening exercises down to a depth of 6000', we are not expecting to recover either drilling fluids or drill cuttings. Nonetheless, we will have a lined sump or tank for recovery of fluid returns should they be obtained from the well after we set the 6000' casing string. If fluid circulation is maintained during the coring and drilling from 6000' to 11,000', the cuttings and drill fluids inventory at the conclusion of the first drilling campaign will be dewatered and disposed of in the county land-fill or, if permitted, will be recycled for other applications.
Drilling Plan

The objective of the present drilling project is to recover a continuous sequence of core from as long a section of Mauna Kea lava flows as is technically feasible. The drilling program is summarized as follows:

1) A 24" diameter hole will be drilled to 30' using a truck mounted auger and an 18.625" diameter conductor casing will be cemented into the hole;
2) A 5" temporary liner will be installed inside the conductor casing (to stabilize the rotating core string) and a 3.85" core hole will be drilled from 30' to 400' depth;
3) The temporary liner will be removed, the hole will be opened to a diameter of 17.5" and a 13.375" USS-H40 casing will be cemented into the hole;
4) The temporary 5" liner will be installed inside the 13.375" casing and a 3.85" core hole will be drilled to a depth of 2000';
5) The temporary liner will be removed, the hole will be opened to a diameter of 12.25" and a 9.625" J-55 casing will be cemented into the hole;
6) The temporary 5" liner will be installed inside the 9.625" casing and a 3.85" core hole will be drilled to a depth of 6000';
7) The temporary liner will be removed, the hole will be opened to a diameter of 8.75" and a 7" K-55 casing will be cemented into the hole;
8) The temporary 5" liner will be installed inside the 7" casing and a 3.85" core hole will be drilled to a depth of 11,000';
9) The temporary liner will be removed and the hole will be opened to a diameter of 6.125" and a 5" L-80 casing will be cemented into the hole;
10) A 3.85" core hole will be drilled to a depth of 14,500' and the final coring string will be cemented into the hole.

Because a number of conditions could occur that would preclude our advancing the hole beyond certain types of geologic features, all the depths listed above are nominal target depths. Should drilling conditions preclude our advancing either the core bit or the hole opening exercises at a particular depth, we will advance to the next step in the plan (either casing, coring or drilling) and attempt to achieve the desired depth at the next hole size by drilling a longer interval. For example, if an unstable sand zone is encountered at 350' that we are unable to stabilize during the hole opening process, we will set and cement the 13.375" casing through the unstable interval and continue coring to 2000' before we begin opening hole to 12.25". It should also be recognized that the hole will be drilled in at least two drilling campaigns. If hole conditions and drilling costs permit, we will drill to 11,000' and set casing during the first drilling campaign and then complete the 11,000' to 14,500' interval during the second drilling campaign. The time interval between the two drilling campaigns will be on the order of two to three years during which the core will be analyzed, downhole fluid sampling will be conducted, and downhole geophysical studies will be performed.

During the drilling operations, the hole will be circulated with drilling fluids to move the cuttings away from the drill bit and to lubricate the drill string. A standard bentonite clay and polymer mix will be used during drilling. Because no fluid returns are anticipated during the first 6000' of drilling, the mud mix during coring will be governed by the
rotational resistance experienced by the drill string. During hole opening intervals, no attempt will be made to recover fluids due to high formation permeability and the futility of past efforts to maintain circulation in large diameter holes in Hawaii. At deeper intervals of the hole, if permeability conditions allow it, we will attempt to maintain fluid circulation using polymer and additional solids as deemed prudent by our drilling engineer.

Our prior experience drilling in this part of Hawaii Island suggests that we will not need pressure control equipment down to a depth of at least 3500': the earlier drilling demonstrated that formation temperatures were colder than surface ambient and that artesian pressures in the freshwater aquifers were no more than a few pounds per square inch. After the 9.625" casing is installed to a depth of 2000', a 3000 psi rated annular preventer and a diverter will be installed on the wellhead. The annular preventer and diverter will be maintained on the wellhead valve from 2000' to the completion of the well unless temperatures substantially higher than are now expected are encountered. Should temperatures of greater than 50% of those needed to produce boiling at the local hydrostatic pressure, we will retain the services of a geothermal drilling engineer to advise us on the recommended Blow Out Prevention Equipment that should be installed on the well at the temperature, pressure, and permeability conditions present in the hole.

In order to maintain a record of downhole temperatures during the coring activity, a core tube temperature and deviation tool will be run into the hole on a daily basis; this measurement frequency will enable us to have an approximate measurement of the downhole temperature at intervals of about 200' or less. Under the conditions that are expected in the hole – of conductive gradients – this frequency will be more than adequate to forewarn the drilling engineer of elevated temperatures and possible pressure in the borehole.

A key element in our drilling plan will be the experience of our senior engineer as well as the experience of the core drill operators. Our senior engineer (Mr. Bruce Howell) has spent more than twenty-five years working in the core drilling industry drilling deep core holes and geothermal core holes in the United States and several foreign countries. Mr. Howell will have final authority over all technical decisions that will be made regarding core rig operation, and on-site operations. Further, the subcontractor that will be selected to provide the core-rig operators will be selected on the basis of the level of staff experience and their capabilities in the operation of deep core drilling equipment.
BRUCE B. HOWELL
2625 West 2000 South
Rexburg, Idaho 83440

TECHNICAL EXPERIENCE:
- Surface Core Drilling
- Crew Training
- Hydraulic/Hydrostatic Systems
- Blow-Out-Prevention Equipment
- Geothermal Core Drilling
- Underground Core Drilling
- Design & Construction of Drilling Rigs & Drilling Equipment

EMployment EXPERIENCE:

Feb. 1996 - Present
Worked as an independent consultant and fabricator.
Directed Oil and gas Slim Hole operation in Newfoundland, Canada Supervised Shell
Slim Hole Coring Project in the Great Sandy Desert near Broom, Australia.
Directed underground operations for Northwest Drilling near Jerome, Arizona.
Rigged up and made user friendly an LF70 Drill for Northwest Drilling to be used for
surface work.
Spent 3 months as a consultant for Dreco in the fabrication and construction
of 2 semi-auto rigs being sent to Petro-Bras in Brazil.
Designed and fabricated several projects through the Rexburg shop: dollies, shop
cranes, Coring package components, etc.

June 1990 - Feb. 1996
TONTO DRILLING SERVICES - Salt Lake City, Utah
Positions held: Sr. Field Supervisor, Shop Foreman, Outside Consultant, Rig Design
and Building. Oversaw, helped design and construct two Longyear 55 truck mount
rigs. Helped design, build, field-test and operate a coring package for an oil field rig,
used in Indonesia on Geothermal wells. Spent two years consulting for the Amoco
Shads Project, developing Slim Hole Drilling. Spent six months training crews on deep
hole coring for Nabors Drilling in Venezuela.

MATRIX - Rexburg, Idaho
Manufacture of welded composite diamond drill rods and dual wall R.C. drill rod.
Commenced working exclusively for Matrix in the main plant in Tennessee and
then established a Western Division facility.
Responsible for building welding fixture for new computer plasma arc welder and its
operation. In charge of Western Division accounting, personnel, and repair operations.

HUDDY/MATRIX - Rexburg, Idaho
Assembly of Electric/Hydraulic drill rigs. Worked with Huddy and Matrix on various
projects. Built 50 hp and 60 hp electric-over-hydraulic power packs for Kempe
underground drills.

BRUCE B. HOWELL

HUDDY/MATRIX JOINT VENTURE - South Africa
Ultra-deep coring program. Worked in South Africa for Matrix Drilling and Huddy, Inc. Responsible for ensuring the purpose-built drill pipe and core barrels worked efficiently. Also assisted in training Parker Drilling personnel in coring techniques.

Sept. 1985 - Feb. 1986

SWISSBORING - Central America

Geothermal coring. In Autumn 1985, set up job in Honduras for Swissboring, contract to Los Alamos Laboratories to conduct a geothermal project in Platanaras, Honduras.

Nov. 1983 - June 1984

R. U. C. - South Africa

Oversaw the assembly of a Strat Master 150 drill rig, designed for coring with top head and table drive capacity. Shipped rig to South Africa, trained crews and maintenance personnel. Drilled to depth of 15,000 feet.

April 1983 - Oct. 1987

B. N. B. REPAIR - Rexburg, Idaho

Machine Shop. Owned and operated machine shop doing general welding and machine shop work, between drilling projects.

April 1980 - April 1983

LONGYEAR COMPANY - Reno, Nevada

Completed assembly and field tests of Hydro 44 rig. Supervised the Mt. Hope job, with as many as 8 rigs, near Eureka, Nevada. Oversaw and directed the rebuild project of the HD600.


AMERICAN MINE SERVICE - Denver, Colorado


May 1978 - Oct. 1978

BOYLES BROS. - Spokane, Washington

Commenced work at the INEL site near Idaho Falls, Idaho on a 3,000 ft. Geothermal hole.

April 1974 - May 1978

IDAHO DIAMOND DRILLING - Rexburg, Idaho

Supervised operation of 5 core rigs; Longyear 44, Longyear 38, Diamec 250. In charge of all drilling operations.
FACSIMILE TRANSMITTAL

To: Eric Tanaka
Company: Land Division
Fax Number: 974-6222
Phone Number: 974-6210

From: Ryan Imata
Date: September 24, 1998
Pages Including Header: 2
Subject: UH HSDP Wells

Notes/Comments:

Eric
Don Thomas sent in this drilling plan and other related items. Can you review this for me? Give me a call if you have any questions.

Mahalo

Ryan
We offer the following regarding the questions of the potential for thermal activity or over-pressured gas formations in the Hawaii Scientific Drilling Project deep hole that were raised in your letter of September 4, 1998. We will address these concerns on two levels. The first is our assessment of the likelihood that geothermal conditions will be encountered on the basis of geological and geophysical evidence. Secondly we will discuss the planned drilling procedures that will be employed to ensure that we will be able to deal with them in a safe manner in the unlikely event that we do encounter pressurized zones.

Stratigraphic Column and Geologic Conditions at the Planned Drill Site
In order to address the question of the probability of encountering elevated temperatures in our deep drill hole, it is necessary to go back to “first principles” of Hawaiian geology. It is widely recognized that two modes of lava emplacement contribute to the construction of the volcanic edifice: lava flow discharge (extrusive activity) and intrusion of magma into the pre-existing edifice (intrusive activity). The former is characterized by the discharge of submarine or subaerial lava flows from an eruptive vent. The extrusive lava flows travel downslope from the eruptive vent and typically range in thickness from a few centimeters to a few meters. Extrusive flows may make up as little as 40% to as much as 80% of a Hawaiian shield volcano. Intrusive activity is associated with the emplacement of a dike or sill within the pre-existing volcanic pile formed from prior extrusive flows and intrusive bodies. Intrusive bodies typically range in width/thickness from a few centimeters to a few meters and are thought to range in depth of emplacement from the surface (e.g. a remnant eruptive vent) to as deep as the base of the volcanic pile. The emplacement of intrusives in Hawaiian volcanoes is not a random process but is governed by gravitational stresses that are present within each volcano. In the great majority of cases, intrusions are confined to the summit calderas (which overlie the conduit through which the magma rises into the volcanic pile) and two or more rift systems that radiate out from the summit magma chamber. The distribution of the rift zones is dictated by the direction of least principal (horizontal) stress in the volcano. As a result, these systems typically form parallel to the unbuttressed seaward flank of the growing volcanic system: a type example would be the Kilauea East Rift Zone.

The rate and mechanism of cooling of extrusives and intrusives is distinctly different. Whereas the extrusive lava flows generally cool very rapidly, the cooling rate for intrusives is much more variable. Because the extrusive flows are exposed directly to the air (or ocean water) they will cool in a matter of hours to a few days. In rare cases, such as small constructional shields (e.g. Mauna Ulu) or lava lakes (Kilauea Iki), cooling may occur over periods of, at most, a few decades. The cooling rate for intrusive bodies is governed by several factors: the thickness of the intrusion; the temperature of the rock into which the magma is intruded (the “country rock”); the permeability of the country rock; and the availability of water in the country rock. In a situation where an intrusion occurs into older extrusive flows above the local water table, it may take decades to possibly centuries for the intrusive to cool to ambient temperature. This is because rock is a poor conductor (or a good insulator) of heat and the absence of large quantities of water reduces the rate of heat loss due to steam formation or convective movement of water. An intrusive body injected into permeable, water saturated rock, may cool much
more quickly since boiling of the groundwater, or convective circulation of the groundwater, can carry heat away from the intrusive much more quickly. If magma is intruded into country rock that has a low permeability and is already hot (such as into a rift zone) the cooling process occurs much more slowly. As a result of the modest amount of intrusive lavas making up Hawaiian volcanoes, as well as their confinement to rift zones, the locations in which high temperature hydrothermal systems are believed to exist are relatively few in number and small in size relative to the mass of the volcanic systems. Exploration for high temperature hydrothermal systems within the state supports this belief: extensive geophysical and geochemical exploration through out the state has identified only the Kilauea East and Southwest Rift Zones as having a high potential for high temperature hydrothermal systems and the Mauna Loa East and Southwest Rift Zones as having a moderate potential for such systems.

As discussed in the Environmental Assessment for the HSDP, the primary scientific objective of the drilling program is to recover an extended sequence of (stratigraphically oriented) samples from the lava flows of an ocean island volcano and to conduct detailed geochemical analyses of these samples. One of the prime criteria for site selection was to avoid intrusive bodies — since they are not stratigraphically emplaced according to their age — and, to the degree possible, avoid the geochemical effects of hydrothermal alteration of the chemical compositions of the lava flows. As seen in the Kilauea East Rift Zone, hydrothermal alteration can almost completely replace the original lava flows and intrusives with clays and secondary minerals that bear little resemblance to the original lava compositions. Hence, one of the most important criteria for selection of the Hilo drill site was the avoidance of the rift system of any volcano. The Hilo site is located about equidistant from the Mauna Kea east rift zone to the north and (to the extent we are able to recognize it) the Mauna Loa rift system to the south. The geophysical data used for guidance in the site selection included both gravity data — which shows rift systems as gravitational highs due to the higher density of the intrusives — and aeromagnetic surveys which show distinct anomalies associated with the Kilauea East Rift Zone.

The pilot drill hole that was completed near the Hilo Harbor in 1993 clearly demonstrates that our effort to avoid recent intrusive or rift zone activity was successful. The temperature gradient in the hole, over the entire depth drilled, showed a temperature gradient of minus 15°C per kilometer depth (i.e. the temperature at the bottom of the hole was 15°C colder than the top). This temperature gradient was driven by circulation of cold deep ocean water through the Mauna Kea (extrusive) lavas. Equally significant was the fact that there was no evidence of any hydrothermal circulation of deep ocean water that would have been expected if a thermal source exists at depth below the drilling site. Had there been a hydrothermal system at intermediate depth we would have expected to see a plume of warm water discharging “across” the hole at some depth. This phenomenon is evident in the Kilauea East Rift Zone where most shallow wells show a layer of warm water at, or near, the surface of the water table. The only feature found in the pilot hole that resembles such a plume was the temperature variation that we found associated with the freshwater outflow at ~300 m depth; analysis of this water has shown that it is derived from fresh recharge that enters Mauna Kea at an elevation of about 2000
m above sea level. The temperature of this water is approximately 15 °C and is not significantly warmer than its average temperature of entry into the groundwater system. Hence, we have no evidence that there is a significant elevation of temperature at intermediate depths below the 1 km depth drilled for the pilot hole.

It might be argued that a buried rift system could be present at some depth below the bottom of the pilot hole and that it may not be discharging sufficient amounts of fluids to be visible in the temperature profile of the pilot hole. We don't believe that this is likely for several reasons. The first is that this rift system would need to be very small or very deep in order to be undetectable to both gravity and aeromagnetic surveys. Secondly, it would have to be a very old rift system. As noted above, the location of intrusive emplacement is governed by gravitational stresses; hence, significant intrusive activity beneath our present site is unlikely to have occurred with a younger volcano of significant size present at Mauna Loa's current location. If an earlier rift system had formed on the south flank of Mauna Kea, it would not have remained active after Mauna Loa built up to a size where it could act as a buttress for this side of Mauna Kea and this is likely have occurred as long as 500,000 years ago. Having such a great age would make it extremely unlikely that temperatures and pressures within this fossil system would approach those found in the Kilauea East Rift Zone, where intrusive events occur at frequencies of years to decades, and almost certainly would not be high enough to pose a threat to the surface equipment.

Finally, there is the possibility that conductive heat loss around the now dormant magma chamber of Mauna Kea could be heating the surrounding rocks without there being substantial convective heat transfer. We don't believe that this type of condition has a significant probability of impacting our operations for two reasons. The first is that we have selected a site that is approximately 45 km from the center of Mauna Kea. The magma chamber of Kilauea and Mauna Loa are estimated to be no more than a few kilometers in diameter on the basis of modelling the inflation/deflation process associated with past eruptive episodes. If we assume even a 10 km diameter magma chamber/dike complex beneath Mauna Kea's summit, then our site is still located about 40 km (radially) away from the edge of the magma chamber. The likelihood of conductive heating of the extrusive material to significant temperatures at this distance from the magma chamber is believed to be remote at best. Further, even if some heating is occurring, the temperature rise would be sufficiently diffuse that we would expect (once we entered into a low-permeability conductive formation) to see a very gradual temperature rise with increasing depth. Finally, it should also be recognized that a low-permeability conductive temperature regime would reduce the likelihood of pressure control problems during drilling. This is because well "kicks" in geothermal environments frequently result from loss of drilling fluids out of the well (into highly permeable formations) and loss of the hydrostatic head that allows the driller to maintain control of the steam pressure in the well. This was the mechanism of the venting episode of the KS-8 well: a highly permeable fracture was encountered, a substantial amount of mud was lost from the wellbore and was followed by steam entry and pressurization of the hole that was only partly filled with drilling fluids.
In summary, our assessment of the likelihood of encountering high formation temperatures at the present drilling location that are the result of volcanic (intrusive) heat from Mauna Kea volcano is so remote as to be considered nearly impossible. This does not necessarily mean that we will not encounter higher temperatures at depth than those already found in the pilot hole. It is recognized that radioactive decay of naturally occurring uranium, thorium, and potassium present in Hawaiian lavas can generate small amounts of heat which could increase formation temperatures with depth. However, the rate of temperature increase with depth will be a direct function of the rate of fluid circulation (and heat loss) within the volcanic pile. The pilot hole demonstrated that high rates of fluid circulation occur to depths of at least 1 km within Mauna Kea. Subaerial lavas may extend to as deep as 2 km and are expected to be underlain by an interval of fragmental material of unknown thickness which may, in turn be underlain by pillow lavas. Because of the high permeability of the subaerial lavas and the underlying fragmental material, any radiogenic heat accumulation will be accompanied by increased fluxes of cold seawater convecting through the system. This latter process will limit both the rate of temperature increase with depth as well as the maximum temperatures that are likely to be attained. Within the highly permeable formations, we do not expect to see temperatures more than a few degrees above the ambient seawater temperature of about 4 °C. As drilling penetrates to greater depths, we may see a progressive deterioration of permeability which can be expected to be accompanied by a gradual rise in temperature. Temperature measurements made in drillholes on the ocean floor have shown that the geothermal gradient in basaltic crust rise at a rate of about 24°C per kilometer depth. At this rate, bottom hole temperatures at a depth of 3300 m (the maximum depth expected during our first drilling campaign) would be 65°C and at 4.5 km, the final depth of the hole, temperatures may reach 97°C. Neither of these expected temperatures will pose a serious threat of blow-out or un-controlled discharge of fluids.

The potential of gas discharges, or pockets of elevated gas or fluid pressures, is related to the issue of temperature. The geology of continental environments allows the formation of high pressure formations (CO₂, methane, or deposits of natural gases associated with oil fields) that are associated with sedimentary deposits of organic material. These geologic structures (sedimentary basins) are not present in Hawaiian volcanoes; this will preclude the accumulation of pressurized natural gas deposits. The only exception to this is in the case of high pressure steam and geothermal gases where the primary vapor present is saturated steam. In the absence of high geothermal temperatures, it is not considered possible for a substantial accumulation of gases to develop - and maintain - significant pressures above local hydrostatic. Hence, this is not believed to be a significant consideration in the drilling of the present research well.
Well Control Strategies

In spite of the low temperature gradient that is projected for this borehole, we are drilling in an area where no holes of similar depth have yet been drilled. Hence, we have designed our drilling program so that any hazardous contingency, within reason, can be safely dealt with and any possible adverse consequences to the equipment, personnel, and site, can be minimized. As a matter of simple prudence, we have included procedures and equipment designs that will enable us to maintain control of the well under any reasonably expected conditions. Included as part of the drilling protocol will be periodic acquisition of downhole temperatures during the core drilling process. Our on-site drilling equipment will include a core-tube logging instrument that will allow us to measure downhole temperatures during the coring process. The instrument will be sent to the bottom of the hole during one (or more, as conditions dictate) coring run each day and will record the fluid temperature immediately above the core bit as that run’s core is being cut. When the core-tube is retrieved, the temperature record can be downloaded to a laptop computer and will enable us to estimate the formation temperature at the depth of that core run. At each casing depth, we will conduct a wireline log of the formation temperatures that will be compared to the temperature estimates derived from the core-tube logger; from this we will be able to maintain an updated correction factor to apply to the next interval’s core-tube temperature measurements. A record of the formation temperatures will be maintained by the drilling engineer; any unusual deviations or excursions can be considered by him in his planning for each day’s drilling activities. If temperatures are encountered that are significantly higher than anticipated, we will suspend drilling to allow a downhole wireline temperature log to be run inside the core tubing string to confirm the formation temperatures. If the temperatures are sufficiently high to warrant additional pressure control precautions, it will be possible to pull the tubing string out the hole and add whatever well control equipment that is deemed necessary.

The well design will be as shown in the attached figure. Conductor casing will be installed at the surface down to a depth of 30'; 13 3/8” USS-H40 surface casing will be installed to a depth of 400'; 9 5/8” J-55 casing will be installed to a depth of 2000'; 7” K-55 casing will be installed to a depth of 6000'; and 5” L-80 casing will be installed to 11,000’. It should be understood, however, that these are target depths: drilling conditions and hole stability will ultimately have to be considered when the casing program is executed. During coring operations, a 5” liner will be installed within each of the larger casing strings to stabilize the rotating core rod and to allow us to better monitor fluid returns (when they do occur). We believe that this casing program will be sufficient to handle any temperature and pressure that we are likely to encounter in the HSDP borehole.

Our prior experience drilling the pilot hole suggests that we will not need pressure control equipment down to a depth of at least 3500’: the earlier drilling demonstrated that formation temperatures were colder than surface ambient and that artesian pressures in the freshwater aquifers were no more than a few pounds per square inch. When the 9 5/8 casing is installed to a depth of 2000’ we will install a 3000 psi annular preventer and a diverter on the wellhead. As noted above, downhole temperature measurements will be
made using the core tube logger on a daily basis. This translates to a measurement being made at intervals of no greater than about every 200' in the shallow interval of the hole; as the depth increases and rate of penetration decreases, the maximum interval of measurement will decrease. If the rate of temperature increase approaches a level that suggests that additional well control measures would be advised, a BOPE stack will be installed on the wellhead. The precise temperature at which this would be considered necessary is difficult to predict since the level of risk of well control problems is related to the temperature, pressure and the formation permeability. As the hydrostatic load on the formation increases, the temperature to which the formation fluid can rise without boiling progressively increases. Similarly, if the drilling conditions indicate that loss of circulation fluids is highly likely, then the margin of safety required will need to be increased. Given these considerations, we will retain the services of a geothermal drilling engineer to advise us as to how best to proceed with the installation of a BOPE if formation temperatures reach more than 50% of boiling temperatures at the local hydrostatic head.
Disposal of drilling fluids and solids

Your letter of September 4 references disposal of large amounts of drill cuttings. It appears that there is a misunderstanding regarding the nature of the drilling program as well as an incomplete understanding of the formation conditions that we are likely to encounter. We will address each separately in an effort to explain why we do not anticipate having large quantities of cuttings material from the present well.

Two types of drilling technology will be applied in our project. As has been indicated in a number of documents describing the project, the objective of the program is to recover core material from the well. While we are using the core drilling technology, we will be grinding a cylindrical hole using a narrow-kerf coring bit. Most of the material removed from the hole during the core operations will be in the form of core; the “cuttings” generated will be a small fraction of the volume of the hole and will be in the form of a fine power rather than cuttings. In the upper part of the hole, we will alternately collect core and then re-enter the hole using a conventional rotary bit or a hole-opening bit to enlarge the diameter of the hole to allow us to set a casing string. As we progress down the hole, the difference in diameter between the coring process and the hole opening exercise will decrease. The first 400’ will be cored with a 3.85” diameter bit and the hole will be opened to 17.5”; from 400’ to 2000’ the 3.85 diameter core hole will be opened to 12.25”; from 2000’ to 6000’ the 3.85” core hole will be opened to 8.75”; and from 6000’ to 11,000’ the 3.85” hole will be opened to 6.125”; below this depth we do not intend to conduct hole opening drilling.

Although the relative hole sizes of the cored and cased hole sections will impact the amount of cuttings generated by the operations, the most important factor governing the amount of material accumulated at the surface will be the formation permeability. As was demonstrated by the pilot hole, the first 3,500’ of drilling will be in subaerial basalts; we expect to be in subaerial formations for at least another 1000’ and possibly as much as another 2500’. Because these basalts are so permeable, the drilling fluids circulated into the hole will almost certainly be lost to the formation as long as any portion of the hole is open to subaerial flows. Hence, during both coring and hole opening exercises down to a depth of 6000’, we are not expecting to recover either drilling fluids or drill cuttings. Nonetheless, we will have a lined sump or tank for recovery of fluid returns should they be obtained from the well after we set the 6000’ casing string. If fluid circulation is maintained during the coring and drilling from 6000’ to 11,000’, the cuttings and drill fluids inventory at the conclusion of the first drilling campaign will be dewatered and disposed of in the county land-fill or, if permitted, will be recycled for other applications.
SET 18 5/8' CASING
SET 5' TEMP. CASING
30 FEET

18 5/8' CASING
87.5 LB. PER FOOT
0.435' WALL
17.567' DRIFT I.D.

CORE 4.125' HOLE
PULL 5' TEMP. CASING
OPEN TO 17 1/2'
SET 13 3/8' CASING
SET 5' TEMP. CASING
400 FEET

13 3/8' CASING
48.0 LB. PER FOOT
0.330' WALL
12.559' DRIFT I.D.
14.375' BUT CPL O.D.

CORE 4.125' HOLE
PULL 5' TEMP. CASING
OPEN TO 12 1/4'
SET 9 5/8' CASING
SET 5' TEMP. CASING
2,000 FEET

9 5/8' CASING
36.0 LB. PER FOOT
0.352' WALL
8.765' DRIFT I.D.
10.125' BUT SP. CLR. CPL O.D.

CORE 4.125' HOLE
PULL 5' TEMP. CASING
OPEN TO 8 3/4'
SET 7' CASING
SET 5' TEMP. CASING
6,000 FEET

7' CASING
23.0 LB. PER FOOT
0.317' WALL
6.241' DRIFT I.D.
7.375' BUT SPL. CLR. CPL O.D.

CORE 4.125' HOLE
PULL 5' TEMP. CASING
OPEN TO 6 1/8'
SET 5' TEMP. CASING
11,000 FEET

5' CASING
15.0 LB. PER FOOT
0.296' WALL
4.283' DRIFT I.D.
FLUSH JOINT CASING

13,400 FEET

HYDRIL #501 3.5 TUBING
3.867' JOINT O.D.
3.500' MIDBODY O.D.
0.254' MIDBODY WALL
2.942' JOINT I.D.
9.30 LB. PER FOOT

CORE 4.125' HOLE
PULL 5' TEMP. CASING
SET LINER
14,000 FEET

CHD 101 COLLAR
3.875' O.D.
14.02 LB. PER FOOT
0.375' WALL
3.125' I.D.

UNIVERSITY OF HAWAII SCIENTIFIC DRILLING PROJECT
HOLE PLAN AUGUST 27, 1998.
Drilling Plan

The objective of the present drilling project is to recover a continuous sequence of core from as long a section of Mauna Kea lava flows as is technically feasible. The drilling program is summarized as follows:

1) A 24" diameter hole will be drilled to 30’ using a truck mounted auger and an 18.625" diameter conductor casing will be cemented into the hole;
2) A 5" temporary liner will be installed inside the conductor casing (to stabilize the rotating core string) and a 3.85" core hole will be drilled from 30’ to 400’ depth;
3) The temporary liner will be removed, the hole will be opened to a diameter of 17.5” and a 13.375” USS-H40 casing will be cemented into the hole;
4) The temporary 5” liner will be installed inside the 13.375” casing and a 3.85” core hole will be drilled to a depth of 2000’;
5) The temporary liner will be removed, the hole will be opened to a diameter of 12.25” and a 9.625” J-55 casing will be cemented into the hole;
6) The temporary 5” liner will be installed inside the 9.625” casing and a 3.85” core hole will be drilled to a depth of 6000’;
7) The temporary liner will be removed, the hole will be opened to a diameter of 8.75” and a 7” K-55 casing will be cemented into the hole;
8) The temporary 5” liner will be installed inside the 7” casing and a 3.85” core hole will be drilled to a depth of 11,000’;
9) The temporary liner will be removed and the hole will be opened to a diameter of 6.125” and a 5” L-80 casing will be cemented into the hole;
10) A 3.85” core hole will be drilled to a depth of 14,500’ and the final coring string will be cemented into the hole.

Because a number of conditions could occur that would preclude our advancing the hole beyond certain types of geologic features, all the depths listed above are nominal target depths. Should drilling conditions preclude our advancing either the core bit or the hole opening exercises at a particular depth, we will advance to the next step in the plan (either casing, coring or drilling) and attempt to achieve the desired depth at the next hole size by drilling a longer interval. For example, if an unstable sand zone is encountered at 350’ that we are unable to stabilize during the hole opening process, we will set and cement the 13.375” casing through the unstable interval and continue coring to 2000’ before we begin opening hole to 12.25”. It should also be recognized that the hole will be drilled in at least two drilling campaigns. If hole conditions and drilling costs permit, we will drill to 11,000’ and set casing during the first drilling campaign and then complete the 11,000’ to 14,500’ interval during the second drilling campaign. The time interval between the two drilling campaigns will be on the order of two to three years during which the core will be analyzed, downhole fluid sampling will be conducted, and downhole geophysical studies will be performed.

During the drilling operations, the hole will be circulated with drilling fluids to move the cuttings away from the drill bit and to lubricate the drill string. A standard bentonite clay and polymer mix will be used during drilling. Because no fluid returns are anticipated during the first 6000’ of drilling, the mud mix during coring will be governed by the
rotational resistance experienced by the drill string. During hole opening intervals, no attempt will be made to recover fluids due to high formation permeability and the futility of past efforts to maintain circulation in large diameter holes in Hawaii. At deeper intervals of the hole, if permeability conditions allow it, we will attempt to maintain fluid circulation using polymer and additional solids as deemed prudent by our drilling engineer.

Our prior experience drilling in this part of Hawaii Island suggests that we will not need pressure control equipment down to a depth of at least 3500'; the earlier drilling demonstrated that formation temperatures were colder than surface ambient and that artesian pressures in the freshwater aquifers were no more than a few pounds per square inch. After the 9.625” casing is installed to a depth of 2000’, a 3000 psi rated annular preventer and a diverter will be installed on the wellhead. The annular preventer and diverter will be maintained on the wellhead valve from 2000’ to the completion of the well unless temperatures substantially higher than are now expected are encountered. Should temperatures of greater than 50% of those needed to produce boiling at the local hydrostatic pressure, we will retain the services of a geothermal drilling engineer to advise us on the recommended Blow Out Prevention Equipment that should be installed on the well at the temperature, pressure, and permeability conditions present in the hole.

In order to maintain a record of downhole temperatures during the coring activity, a core tube temperature and deviation tool will be run into the hole on a daily basis; this measurement frequency will enable us to have an approximate measurement of the downhole temperature at intervals of about 200’ or less. Under the conditions that are expected in the hole – of conductive gradients – this frequency will be more than adequate to forewarn the drilling engineer of elevated temperatures and possible pressure in the borehole.

A key element in our drilling plan will be the experience of our senior engineer as well as the experience of the core drill operators. Our senior engineer (Mr. Bruce Howell) has spent more than twenty-five years working in the core drilling industry drilling deep core holes and geothermal core holes in the United States and several foreign countries. Mr. Howell will have final authority over all technical decisions that will be made regarding core rig operation, and on-site operations. Further, the subcontractor that will be selected to provide the core-rig operators will be selected on the basis of the level of staff experience and their capabilities in the operation of deep core drilling equipment.
BRUCE B. HOWELL  
2625 West 2000 South  
Rexburg, Idaho 83440

TECHNICAL EXPERIENCE:
- Surface Core Drilling  
- Crew Training  
- Hydraulic/Hydrostatic Systems  
- Blow-Out-Prevention Equipment  
- Geothermal Core Drilling  
- Underground Core Drilling  
- Design & Construction of Drilling Rigs & Drilling Equipment

EMPLOYMENT EXPERIENCE:

Feb. 1996 - Present  
Worked as an independent consultant and fabricator.  
Directed Oil and gas Slim Hole operation in Newfoundland, Canada  
Supervised Shell Slim Hole Coring Project in the Great Sandy Desert near Broom, Australia.  
Directed underground operations for Northwest Drilling near Jerome, Arizona.  
Rigged up and made user friendly an LF70 Drill for Northwest Drilling to be used for surface work.  
Spent 3 months as a consultant for Dreco in the fabrication and construction of 2 semi-auto rigs being sent to Petro-Bras in Brazil.  
Designed and fabricated several projects through the Rexburg shop: dollies, shop cranes, Coring package components, etc.

June 1990 - Feb. 1996  
TONTO DRILLING SERVICES - Salt Lake City, Utah  
Positions held: Sr. Field Supervisor, Shop Foreman, Outside Consultant, Rig Design and Building.  
Oversaw, helped design and construct two Longyear 55 truck mount rigs.  
Helped design, build, field-test and operate a coring package for an oil field rig, used in Indonesia on Geothermal wells.  
Spent two years consulting for the Amoco Shads Project, developing Slim Hole Drilling.  
Spent six months training crews on deep hole coring for Nabors Drilling in Venezuela.

MATRIX - Rexburg, Idaho  
Manufacture of welded composite diamond drill rods and dual wall R.C. drill rod.  
Commenced working exclusively for Matrix in the main plant in Tennessee and then established a Western Division facility.  
Responsible for building welding fixture for new computer plasma arc welder and its operation.  
In charge of Western Division accounting, personnel, and repair operations.

HUDDY/MATRIX - Rexburg, Idaho  
Assembly of Electric/Hydraulic drill rigs.  
Worked with Huddy and Matrix on various projects.  
Built 50 hp and 60 hp electric-over-hydraulic power packs for Kempe underground drills.

BRUCE B. HOWELL  
HUDDY/MATRIX JOINT VENTURE - South Africa
Ultra-deep coring program. Worked in South Africa for Matrix Drilling and Huddy, Inc. Responsible for ensuring the purpose-built drill pipe and core barrels worked efficiently. Also assisted in training Parker Drilling personnel in coring techniques.

Sept. 1985 - Feb. 1986
SWISSBORING - Central America

Geothermal coring. In Autumn 1985, set up job in Honduras for Swissboring, contract to Los Alamos Laboratories to conduct a geothermal project in Platanaras, Honduras.

Nov. 1983 - June 1984
R. U. C. - South Africa

Oversaw the assembly of a Strat Master 150 drill rig, designed for coring with top head and table drive capacity. Shipped rig to South Africa, trained crews and maintenance personnel. Drilled to depth of 15,000 feet.

April 1983 - Oct. 1987
B. N. B. REPAIR - Rexburg, Idaho

Machine Shop. Owned and operated machine shop doing general welding and machine shop work, between drilling projects.

April 1980 - April 1983
LONGYEAR COMPANY - Reno, Nevada

Completed assembly and field tests of Hydro 44 rig. Supervised the Mt. Hope job, with as many as 8 rigs, near Eureka, Nevada. Oversaw and directed the rebuild project of the HD600.

AMERICAN MINE SERVICE - Denver, Colorado


May 1978 - Oct. 1978
BOYLES BROS. - Spokane, Washington

Commenced work at the INEL site near Idaho Falls, Idaho on a 3,000 ft. Geothermal hole.

April 1974 - May 1978
IDAHO DIAMOND DRILLING - Rexburg, Idaho

Supervised operation of 5 core rigs; Longyear 44, Longyear 38, Diamec 250. In charge of all drilling operations.
Mr. Eugene S. Imai  
University of Hawaii  
Bachman Hall  
2444 Dole Street  
Honolulu, Hawaii 96822

Dear Mr. Imai:

Well Construction / Pump Installation Permit Applications for Well No. 4203-16 and 17

On June 24, 1998, we approved and sent you your well permits referenced above for validation via you and your well drilling contractor. To date, we have not yet received these permits signed and validated. Because of the uniqueness of your wells and recent additional issues raised within DLNR, we are currently suspending your permits for the HSDP Wells (Well No. 4203-16 and 17) until the following items are addressed and resolved:

1. Issues relating to Health and Safety
   a. Please submit a Drilling Plan, describing items such as disposal of the large amount of cuttings, disposal of drilling fluids, etc. which will result from this 15,000 foot deep well.
   b. Please provide a list of surface equipment that will be used to ensure safety, should deep geothermal activity be encountered which may result in well blow outs.

2. It is our understanding that a well described as the "Hawaii Pilot Hole" was drilled by the University of Hawaii in 1993. The geophysical research hole drilling permit issued by the Division of Water and Land Development did not exempt the University of Hawaii from the requirement for a well construction permit issued by the Commission on Water Resource Management. Therefore, this well requires an after-the-fact Well Construction Permit application and, if applicable, an after-the-fact Pump Installation Permit application.

As soon as these items are received, we will reissue your permits within 90 days.

If you have any questions, please contact Mr. Ryan Imata of the Commission staff at 587-0255.

Sincerely,

TIMOTHY E. JOHNS  
Deputy Director

RI:ss
September 2, 1998

To: Roy Hardy
Water Resource Management

From: Eric Tanaka
Engineering Section, Hilo

Re: Attached copies of Chapter 183 of Geothermal Resource Regulations

Attached are pages of the Administrative Rules Chapter 183 governing over Geothermal Development that would be pertinent to the deep geological exploration well submitted for permit by the University of Hawaii and Dr. Donald Thomas. Highlighted in yellow would be the pertinent items that would have to be addressed when drilling of the deep hole.

If there are any questions to any of the above, please feel free to call on me at any time.

Mahalo,
Subchapter 8. Drilling; Wells Generally

§13-183-64 Designation of agent. Any person who has drilled, is drilling, or proposes to drill any geothermal well shall designate on forms provided by the department an agent who shall be a resident of the State and upon whom may be served all orders, notices, and processes of the department or any court of law. Every person appointing an agent shall, within five days after the termination of any agency, notify the chairperson in writing of the termination, and unless operations are discontinued, shall appoint a new agent. All changes in the address of an agent shall be recorded with the chairperson within five days of the change of the address. [Eff. JUN 22 1981] (Auth: HRS §182-14).

§13-183-65 Applications for permit to drill, modify, modify use, or abandon wells; permits. Prior to drilling, modifying, modifying use, or abandoning of any well, the operator of the well shall file with the chairperson an appropriate application for a permit to any work and shall obtain approval thereof. Each application for a permit shall be made on forms provided by the department and shall contain the following:

(1) Name, signature and address of the applicant, the owner of the mining rights and the land owner if the applicant is not the land owner.

(2) The number or other designation by which the well shall be known. The number or designation shall be subject to the chairperson's approval.

(3) A plot plan showing the tax map key, site elevation, and well location reference to established property corners. A survey by a Hawaii licensed surveyor may be required by the department, if deemed necessary.

(4) A statement by applicant of the purpose and extent of the proposed work and an estimate of the depths between which discovery, production, injection, or plugging will be attempted.

(5) A description of the proposed drilling and casing program; and a plan or drawing showing the proposed work and vertical section of the well.

(6) A statement by applicant agreeing to file a bond meeting the requirements of §13-183-68 with the chairperson within ten calendar days after notification that the application has been approved.
(7) A statement by applicant to perform the work and thereafter to operate and maintain the well in accordance with these rules and all other federal, state and county requirements.

(b) Applications for a permit shall be reviewed and acted upon by the chairperson within sixty calendar days after receipt.

(c) Permits shall be valid for a period of 365 calendar days from date of issuance, but may be renewed for an additional period of 180 calendar days at the discretion of the chairperson.

(d) A permit may be suspended or revoked by the chairperson. If it appears that any drilling or well work for which a permit has been issued is not being done in accordance with conditions of the permit or these rules, the chairperson shall notify the permittee to appear before him at a time and place designated in the notice to show cause why the permit should not be suspended or revoked and the well be plugged and abandoned or put in proper condition by the permittee. The notice shall state the grounds for suspension or revocation. After the hearing, the chairperson shall give an order of revocation, suspension or continuation of the permit. The order shall be subject to appeal as provided in §13-183-5. [Eff. JUN 22 1981 ]

§13-183-66 Supplementary applications. A supplementary application shall be filed with the chairperson if there is any contemplated change in the original approved application. Written approval of the change shall be received from the chairperson before the change of work is started. In an emergency or when deemed necessary by the chairperson, the chairperson may give verbal approval to the operator to carry out the intent and purpose of these rules. [Eff. JUN 22 1981 ]

§13-183-67 Filing fees. Each application for a permit to drill, modify, modify use or abandon a well shall be accompanied by a non-refundable filing fee in the amount of $100. [Eff. JUN 22 1981 ]

§13-183-68 Bonds. (a) Any person who engages in the drilling, redrilling, deepening, maintaining, operating, or abandoning of any well shall file with the chairperson prior to the activity, an indemnity bond in the amount set by the board to protect the interests of the State, but in no case shall the amount be less than $50,000 for each well or a blanket bond of $250,000 for any number of wells. The amount of bond set by the board shall include the cost of plugging and abandoning
§13-183-70 Directional drilling. (a) Where the surface of a parcel of land is unsuitable for drilling, a directionally drilled (other than a vertical direction) well may be located upon another parcel which may or may not be contiguous. The location of a well shall be not less than twenty-five feet from the outer boundary of the parcel of which it is located and not less than twenty-five feet from an existing street or road. The production or injection interval of a well shall be not less than one hundred feet from the outer boundary of the parcel into which it is drilled. Directional well surveys shall be filed with the department for all wells directionally drilled.

(b) No well shall be intentionally deviated from the vertical without the chairperson's approval.

(Imp: HRS §182-14)

§13-183-71 Casing and cementing requirements.

(a) All wells shall be cased in a manner to protect and prevent or to minimize damage to the environment, ground water resources, geothermal resources, life, health, and property. The permanent well head completion equipment and all casing strings reaching the surface shall provide for adequate well pressure control, operational safety, and protection of all natural resources. Department specifications for casing strings shall be determined on a well-to-well basis. All casing strings reaching the surface shall provide adequate anchorage for blowout-prevention equipment, hole pressure control and protection for all natural resources. The casing requirements described below are general and should be used as guidelines in submitting proposed casing programs required to be filed with applications for permit.

(b) Conductor pipe shall be installed to a depth of a minimum of fifty feet and a maximum of one hundred fifty feet. In special cases the chairperson may allow conductor pipe to be run and cemented at deeper depths. The annular space between the hole and pipe shall be cemented solid to the surface.

(c) Surface casing shall be installed to provide for control of formation fluids, for protection of ground water resources, and for anchorage of blowout-prevention equipment. All surface casing shall be cemented solid to the surface.

(d) Surface casing shall be set to a minimum depth of ten percent of the proposed total depth of the well or five hundred feet, whichever is greater. If usable basal ground water is present or reasonably suspected to exist in the area, the depth of the surface casing shall be approved by the chairperson. If subsurface geological, hydrological, or geothermal condi-
tions are to be or within the vicinity of the area to be drilled; then these conditions shall be used in determining and approving the depth of surface casing. A second string of surface casing may be required if the first string has not been cemented through a sufficient series of low permeability, competent rock formations or a rapidly increasing thermal gradient or rapidly increasing formation pressures are encountered.

(e) Intermediate casing shall be required for protection against anomalous pressure zones, cave-ins, washouts, abnormal temperature zones, uncontrollable lost circulation zones or other drilling hazards. Intermediate casing strings shall be cemented solid to the surface.

(f) Production casing may be set above or through the producing or injection zone and cemented above the zones. Sufficient cement shall be used to exclude overlying formation fluids from the zone, to segregate zones and to prevent movement of fluids behind the casing into zones that contain ground water. Production casing shall either be cemented solid to the surface or lapped into intermediate casing, if installed. If the production casing is lapped into an intermediate string, the casing overlap shall be at least fifty feet, the lap shall be cemented solid and the lap shall be pressure tested to ensure the integrity of the lap.

In order to reduce casing corrosion, production casing used to produce corrosive brine reservoirs shall be of the same nominal inside diameter from the shoe of the casing to the ground surface unless waived by the chairperson.

(g) All cement used in cementing the various types of casing required herein shall contain a high temperature resistant admix, unless this cement requirement is waived by the chairperson due to the particular circumstances existing in the well or the area.

§13-183-72 Mud return temperature logging.

The temperature of the return drilling mud shall be monitored continuously during drilling of the surface casing portion of the drill hole. Either a continuous temperature monitoring device shall be installed and maintained in a working condition, or the temperature shall be installed and maintained in a working condition, or the temperature shall be read manually. Return mud temperatures shall be entered into the log book after each joint of pipe has been drilled down (about every thirty feet).
§13-183-73 Electric well logging. All wells, except observation wells, shall be logged with an induction electrical log, or other approved log from total depth to the bottom of the conductor pipe before installing casing, except in the case where air is used as the drilling medium. This requirement may vary from area to area, depending upon the amount of subsurface geological or hydrological data available and may not be required from total depth of the well under certain conditions, subject to the approval of the chairperson. [Eff. JUN 32 1981] (Auth: HRS §182-14) (Imp: HRS §182-14)

§13-183-74 Blowout-prevention equipment. (a) Blowout-prevention equipment ("BOPE") capable of shutting-in the well during any operation shall be installed on the surface casing tested and shall be maintained ready for use at all times. BOPE pressure tests may be observed by the chairperson or his designated representative on all exploratory wells prior to drilling out the shoe of the surface casing. The decision to require and observe BOPE pressure tests on other types of wells shall be made on a well-to-well basis. The chairperson shall be contacted in advance of a scheduled pressure test to allow time for travel to the well site to witness the test. BOPE installations shall include high temperature-rated packing units and ram rubbers if available and shall have a minimum working-pressure rating equal to or greater than the lesser of:

1. A pressure equal to the product of the depth of the BOPE anchor string in feet times one psi per foot;
2. A pressure equal to the rated burst pressure of the BOPE anchor string; or
3. A pressure equal to 2000 psi.

(b) The requirements for blowout-prevention equipment shall be subject to review and modification by the chairperson. The following standards serve as guidelines for preparation of minimum blowout-prevention programs:

1. No BOPE is required for known shallow, low temperature, low pressure areas where down-hole water temperatures are less than one hundred degrees Celsius at depths less than five hundred feet or where temperatures and pressures are unknown and the proposed depth of drilling is less than five hundred feet.
2. CLASS 2M BOPE (API CLASS 2M-A or 2M-RE) is required for low pressure areas where known temperatures are
above one hundred degrees Celsius at depths less than 2,000 feet, or where sub-surface temperatures and pressures are unknown and the proposed depth of drilling is less than 2,000 feet. Equipment shall include:

(A) An annular BOPE or pipe-ram/blind-ram BOPE with minimum working-pressure ratings of 1,000 psi installed on the surface casing so that the well can be shut-in at any time;

(B) Hydraulic and/or manual actuating system;

(C) Kelly cock;

(D) A fill-up line installed above the BOPE;

(E) A kill line installed below the BOPE, leading directly to the mud pumps and fitted with a valve through which cement could be pumped if necessary; and

(F) A blow-down line fitted with two valves installed below the BOPE. The blow-down line shall be directed in a manner so as to permit containment of produced fluids and to minimize any safety hazard to personnel.

(3) CLASS 3M BOPE (API CLASS 2M-RSRA or EQUIVALENT) is required for medium pressure areas where subsurface pressures are less than 1000 psi or where pressures are unknown and the proposed total depth of the well is greater than 2000 feet. Equipment shall include:

(A) Annular BOPE and pipe-ram/blind-ram BOPE with a minimum working-pressure rating of 2,000 psi installed on the surface casing so that the well can be shut-in at any time and with a double-ram preventer having a mechanical locking device;

(B) A hydraulic actuating system utilizing an accumulator of sufficient capacity and a high pressure auxiliary backup system equipped with dual controls, one at the driller's station and one
at least fifty feet away from the well head;

(C) Kelly cock and standpipe valve;

(D) A fill-up line installed above the BOPE;

(E) A kill line installed below the BOPE, leading directly to the mud pumps and fitted with a valve through which cement could be pumped if necessary; and

(F) A blow-down line fitted with two valves installed below the BOPE with blow-down line directed in such a manner as to permit containment of produced fluids and to minimize any safety hazard to personnel.

(4) CLASS 1A BOPE is required in areas where dry steam is known to exist and/or formation pressures are less than hydrostatic and air is used as the drilling medium. Equipment shall include:

(A) A rotating-head installed at the top of the BOPE stack;

(B) A pipe-ram/blind-ram BOPE, with a minimum working-pressure rating of 1,000 psi, installed below the rotating-head so that the well can be shut-in any any time;

(C) A banjo-box steam diversion unit installed below the double-ram BOPE, fitted with a muffler capable of lowering sound emissions to within acceptable standards;

(D) A blind-ram BOPE, with a minimum working-pressure rating of 1,000 psi, installed below the banjo-box so that the well can be shut-in while removing the rotating-head during bit changes;

(E) A gate valve required on final casing string to be cemented back to surface, with a minimum working-pressure rating of three hundred psi, installed below the blind-ram so that the well can be shut-in after the well has been completed, prior to removal of the BOPE stack;

(F) All ram-type BOPE shall have a hydraulic actuating system utilizing an accumulator of sufficient capacity and a high-pressure backup system, one at the driller's station.
and the other at least fifty feet away from the well head;

(G) Kelly cock and standpipe valves;

(H) A kill line installed below the BOPE, leading directly to the mud pumps and fitted with a valve through which cement could be pumped if necessary; and

(I) A blow-down line fitted with two valves installed below the BOPE. This line shall be directed so as to minimize any safety hazard to personnel. If any portion of a well is drilled using mud, Class 2M BOPE shall be installed on the surface casing so that the well can be shut-in at any time.

§13-183-75 Well completion. A well is considered to be completed thirty days after drilling operations have ceased and the well is capable of producing a geothermal resource, or thirty days after it has commenced to produce a geothermal resource, unless drilling operations are resumed before the end of the thirty-day period. For the purpose of filing well records, the time limit of sixty days begins either when the well commences production or injection, the drilling operations are suspended for more than thirty days, or the well is abandoned. [Eff. JUN 22 1981 ] (Auth: HRS §182-14) (Imp: HRS §182-14)

§13-183-76 Well tests. (a) The chairperson shall require the well tests or remedial work as necessary to prevent and minimize damage to life, health, property, natural resources, geothermal resources, ground water resources, and the environment. Tests may include casing tests, cementing tests, directional tests, or equipment tests.

(b) All casing strings shall be pressure tested after cementing and before commencing any other operations on the well. Minimum casing test pressure shall be approximately one-third of the manufacturer's rated internal yield pressure; provided that the test pressure shall not be less than six hundred pounds per square inch and greater than 1500 pounds per square inch. In cases where combination strings are involved, the above test pressures shall apply to the lowest pressure-rated casing used. Test pressures shall be applied for a period of thirty minutes. If a drop of more than ten percent of the test pressure should occur, the casing or cement job shall be considered defective and corrective
measures shall be taken before commencing any further operations on the well.

(c) If the cementing of any casing appears to be defective, or if the casing in any well appears to be defective or corroded or parted, or if there appears to be any underground leakage for whatever other reason which may cause or permit underground waste, the operator shall proceed with diligence to use the appropriate method or methods to eliminate the hazard. If the hazard of waste cannot be eliminated, the well shall be plugged and abandoned in accordance with a plugging program approved by the chairperson.

(d) All wells shall be tested to determine the deviation from the vertical at maximum intervals of five hundred feet or less. [Eff. JUN 22 1981 ]

Subchapter 9. Drilling; Modification of Well for Injection Use

§13-183-77 Injection wells. Injection wells are those wells used for disposal of geothermal waste fluids, for the augmentation of geothermal reservoir fluids, for maintenance of reservoir pressures, or for any other purpose authorized by the chairperson. New wells may be drilled or old wells may be modified for injection purposes. [Eff. JUN 22 1981 ]

§13-183-78 Permit required. Prior to modification of existing wells for injection purposes, an appropriate application for permit shall be filed with the chairperson together with filing fee, as required in §13-183-65. Modification work shall not commence until a permit has been issued by the chairperson. [Eff. JUN 22 1981 ]

§13-183-79 Surveillance of injection wells.
(a) Surveillance of injection wells shall be necessary in order to establish that all injection effluent is confined to the intended zone of injection. When an owner or operator proposes to drill a new well or modify an existing well the owner or operator shall be required to demonstrate to the satisfaction of the chairperson that the casing has complete integrity by approved test methods.

(b) To establish the integrity of the annular cement above the shoe of the casing, the operator shall make sufficient surveys, within thirty days after injection is started into a well, to demonstrate that all the injected fluid is confined to the intended zone of injection. Surveys shall thereafter be made at least
(c) The operator of any well shall notify the chairperson of any blowout, break, leak, or spill of any well or appurtenant facilities. The notification to the chairperson shall consist of a written report submitted within ten days after discovery of the incident. 
(d) The chairperson shall notify the operator of any well not being operated or maintained in accordance with these rules to take whatever steps may be necessary to remedy the defect at the operator's expense within the period of time specified in the notice. If the operator fails to comply with the notice and remedy the defect within the specified period, the chairperson may do the work as may be necessary to plug and abandon the well or put it in proper condition at the expense of the operator or the surety and the chairperson may take necessary action to enforce the penalty provided in these rules. [Eff. JUN 22 1981] (Auth: HRS §182-14) (Imp: HRS §182-14)

Subchapter 11. Drilling; Abandonment of Wells

§13-183-81 Notice of intent to abandon; permit; filing fee. The operator of any well proposed to be abandoned shall file with the chairperson an application for permit to abandon, prior to the abandonment. The operator's proposed plans for abandonment shall be subject to approval and revision prior to the issuance of a permit by the chairperson. Each application to abandon a well shall be accompanied by a non-refundable filing fee of $100. [Eff. JUN 22 1981] (Auth: HRS §182-14) (Imp: HRS §182-14)

§13-183-82 General requirements. (a) The operator of any well shall promptly plug and abandon any well that is deserted, not in use, is deemed not to be potentially useful, is wasting geothermal or ground water resources, or is irreparably damaged. No well shall be plugged and abandoned until the manner and method of plugging have been approved or prescribed by the chairperson.
(b) Before any work is commenced to abandon any well, notice shall be given by the operator to the chairperson, which notice shall show the condition of the well and the proposed method of abandonment. Unless otherwise specified in the plan of operation, no well may be abandoned except as prescribed herein. The operator of a lease shall promptly plug and abandon any well that is deserted or not used or deemed useful by the board. No well capable of producing in commercial quantities may be abandoned until receipt of written approval by the chairperson. Equipment shall be removed and premises at the well site shall be restored as near
as reasonably possible to its original condition immediately after plugging operations are completed on any well except as otherwise authorized by the chairperson. When drilling operations have been temporarily suspended drilling equipment shall not be removed from any well without taking adequate measures to close the well and protect subsurface resources. Failure of lessee to comply with any requirements under this rule shall authorize the chairperson to cause the work to be performed at the expense of lessee and the surety.

(c) Good quality, heavy drilling fluid approved by the chairperson shall be used to replace any water in the hole and to fill all portions of the hole not plugged with cement.

(d) Subsequent to plugging and abandonment operations in the hole, casing shall be cut off at least six feet below the surface of the ground, all concrete cellars and other structures shall be removed, and the surface location restored, as near as practicable, to original conditions.

(e) A history of the well shall be filed within sixty days after completion of abandonment; provided that in the case of an exploratory well the report shall be filed within six months after abandonment.

(f) Any bond or rider thereto covering the well shall remain in full force and effect until the well is properly abandoned and the surface properly restored. Written approval of the abandonment shall be obtained from the chairperson before any bond is released.

§13-183-83 Cementing requirements. (a) Cement used to plug any well, except that cement or concrete used for surface plugging, shall be placed in the hole by pumping through drill pipe or tubing. The cement shall contain a high temperature resistant admix unless this requirement is waived by the chairperson the particular circumstances existing in that well or area. All open annuli shall be filled solid with cement to the surface.

(b) One hundred lineal feet of cement shall be placed straddling the bottom of the conductor pipe and at the shoes of all casings.

(c) Cement shall be placed solidly across geothermal zones and extending one hundred lineal feet above and below the zones, whether in uncased or cased (perforated) hole, except as follows:

(1) One hundred lineal feet of cement shall be placed straddling casing stubs and laps. If unable to enter casing stubs or laps, one hundred lineal feet of cement shall be placed above the top of the stubs or laps.
(2) If casing is collapsed, etc., cement shall be placed solidly in geothermal zones or perforated sections of casing and extending one hundred lineal feet above the zone or perforated section by squeezing with a retainer or braden head.

(d) Fifty lineal feet of cement shall be placed above the top of casing liners.

(e) A surface plug consisting of a minimum of fifty lineal feet of neat cement or ready mix concrete shall be placed below the surface of the well.

(f) Where a well has been drilled with air, a bridge plug may be placed at the deepest cemented casing shoe and the bridge plug shall be capped with a minimum of two hundred lineal feet of cement.

Subchapter 12. Drilling; Records and Reports of Wells

§13-183-84 Well records. (a) The operator of any geothermal well shall keep, or cause to be kept, a careful and accurate log, core record, and history of the drilling of the well, including:

(1) Lithology and depths of formations encountered;
(2) Cores;
(3) Water-bearing and geothermal heat-bearing strata and their depths, pressures and temperatures; and
(4) Other well surveys and logs of temperature, chemical, radioactive, and electrical characteristics of the well.

(b) These records shall be kept within the state in the local office of the operator or his designated agent and together with all other reports of the operator, shall be subject, during business hours, to the inspection of the chairperson. The board may also require the additional data or reports relating to production or utilization of geothermal resources and by-products as may appear to be necessary or desirable, either generally or specifically, for the prevention of waste and the optimum use of geothermal, water and other natural resources of the state. [Eff. JUN 22 1981] (Auth: HRS §182-14) (Imp: HRS §§178-3, 182-14)

§13-183-85 Reports to be filed. Within six months after the completion of any well or completion of any deepening, redrilling, plugging, altering, or abandonment work, the operator shall file with the
department of land and natural resources in Honolulu, Hawaii, the following well reports on forms provided by the department:

1. Drilling log and core report. The drilling log and core report shall show the lithologic characteristics and depths of formations encountered, the depths and temperatures of ground water-bearing and geothermal resources-bearing strata, and the temperatures, chemical compositions, and other chemical and physical characteristics of fluids encountered from time to time, so far as ascertained. The report shall show the depth, lithologic character and fluid content of cores obtained, so far as determined.

2. Well history report. The well history report shall describe in detail the chronological order on a daily basis all significant operations carried out and equipment used and shall be submitted upon completion of drilling, testing, completion, recompletion and abandonment of a well.

3. Well summary report. The well summary report shall show data pertinent to the condition of a well at the time of completion of work done. Well locations shown on this form shall be surveyed by a licensed surveyor.

4. Supplementary notice. Reports on any other operations not specifically mentioned herein which affect the previous reported status of a well shall be reported on the supplementary notice form.

5. All reports shall be the property of the state with the right to utilize the same.

§13-183-86 Monthly production and injection reports to be filed. The operator of any well which is producing geothermal resources or by-products or is being used for injection purposes shall file with the chairperson on or before the thirtieth day after the end of each month a report on the amount of geothermal resources produced, sold, and used, and the amount of fluid injected for that month as the case may be.

(Imp: HRS §§178-6, 182-14)
Subchapter 13. Drilling: Environmental Protection Requirements

§13-183-87 Environmental protection. (a) Protection of the environment includes responsibility of the operator of any well to:

1. Conduct exploration, drilling, and development operations in a manner deemed necessary by the chairperson to provide maximum protection of the environment;

2. Rehabilitate disturbed lands;

3. Take all precautions deemed necessary by the chairperson to protect the public health and safety; and

4. Conduct operations in accordance with the intent and objectives of these rules and all other applicable federal, state, and county environmental legislation.

(b) Adverse environmental impacts from geothermal-related activity shall be prevented or mitigated through enforcement of these rules and of all other applicable federal, state, and local standards, and the application of existing technology. Inability to meet these environmental standards or continued violation of environmental standards by any well operator after due notification, may be construed as grounds for the chairperson to order a suspension of well operations.

(c) The operator of any well shall be responsible for monitoring readily identifiable localized environmental impacts associated with specific activities that are under the operator's control. Monitoring of environmental impacts may be conducted by the use of aerial surveys, inspections, periodic samplings, continuous records, or by other means or methods as required by the chairperson. Due to the differing natural environmental conditions among geothermal areas, the extent and frequency of monitoring activities shall be approved by the chairperson on an individual well basis. In the event the chairperson determines that the degree and adequacy of existing environmental protection rules in certain areas are insufficient, the chairperson may establish additional and more stringent requirements.

The operator of any well shall provide for acquisition of adequate environmental baseline data prior to submission of a plan for production. Techniques and standards to be used by the operator for meeting these requirements shall be subject to the approval of the chairperson.

(d) The operator of any well shall reduce visual pollution, where feasible, by the careful selection of sites for operations and facilities. The design and
construction of facilities shall be conducted so that the facilities will blend into the natural environmental setting of the area by the appropriate use of landscaping, vegetation, compatible color schemes, and minimum profiles. Native plants or other compatible vegetation shall be used, where possible, for landscaping and revegetation.

(e) Drilling and operating plans shall be designed so that the operations will result in the least disturbance of land, water, and vegetation. Existing roads shall be used where feasible. Entry upon certain environmental fragile land areas may be either seasonally restricted or restricted to special vehicles or transportation methods which will minimize disturbance to the surface or other resources as specified by the chairperson. Plans for drilling operations shall provide for the reclamation and revegetation of all disturbed lands in a manner approved by the chairperson. Land reclamation may include preparation and seeding with prescribed wildlife food and plant cover or improved and acceptable substitutes thereof which will equal or enhance the food values for indigenous wildlife species and domesticated animals. Temporary fencing for the reclaimed areas may be required to facilitate restoration thereof.

(f) Operations shall be conducted in a manner which minimizes erosion and disturbance to natural drainage. The operator of any well shall provide adequate erosion and drainage control to prevent sediments from disturbed sites from entering water courses for soil and natural resource conservation protection.

(g) The operator of any well shall conduct all operations in a manner which provides reasonable protection of fish, wildlife, and natural habitat. The operator shall take measures necessary for the conservation of endangered and threatened species of flora and fauna.

(h) The operator of any well shall exercise due diligence in the conduct of his operations to protect and preserve significant archaeological, historical, cultural, paleontological, and unique geologic sites. Previously unknown sites discovered during any operations shall be immediately reported to the chairperson, and operations on that site shall cease until said site can be assessed for its archaeological value.

(i) The operator of any well shall comply with all applicable federal, state, and local standards with respect to air, land, water, and noise pollution, and the disposal of liquid, solid, and gaseous effluent. Immediate corrective action approved or prescribed by the chairperson shall be taken in all cases where pollution has occurred or abatement is deemed necessary. The disposal of well effluents shall be done in a manner
that does not constitute a hazard to surface or ground water resources.

(f) The operator of any well shall design, plan, and conduct all well drilling, casing and cementing operations in a manner which provides for protection of all usable ground water resources from exhaustion, depletion, waste, pollution, and salt water encroachment or the threat thereof. [Eff. JUN 22 1981]
(Auth: HRS §182-14) (Imp: HRS §182-14)
To: Eric Tanaka
Company: Land Division
Fax Number: 974-6222
Phone Number: 974-6210

From: Ryan Imata
Date: September 2, 1998
Subject: HSDP Wells

Pages Including Header: 2

Notes/Comments:

Eric -

Please comment on our letter requesting additional items before we finalize and send to Imai.

Please call me at 587-0255 if you have any questions.

Thanks

Ryan

Roy - let's talk about this when you get back.
Dear Mr. Imai:

**Well Construction / Pump Installation Permit Applications for Well No. 4203-16 and 17**

On June 24, 1998 we approved and sent you your well permits referenced above for validation via you and your well drilling contractor. To date, we have not yet received these permits signed and validated. Because of the uniqueness of your wells and recent additional issues raised within DLNR, we are currently suspending your permits for the HSDP Wells (Well No. 4203-16 and 17) until the following items are addressed and resolved:

1. **Issues relating to Health and Safety**
   a. Please submit a Drilling Plan, describing items such as disposal of the large amount of cuttings, disposal of drilling fluids, etc. which will result from this 15,000 foot deep well.
   b. Please provide a list of surface equipment that will be used to ensure safety, should deep geothermal activity be encountered which may result in well blowouts.

2. It is our understanding that a well described as the "NSF Pilot Project Well" was drilled by your program in 19[ ] . If so, this will require an after-the-fact Well Construction Permit application and if applicable, an after-the-fact Pump Installation Permit application.

If you have any questions, please contact Mr. Ryan Imata of the Commission staff at 587-0255.

Sincerely,

TIMOTHY E. JOHNS
Deputy Director

RI:ss
FACSIMILE TRANSMITTAL PAGE

Please deliver the following pages to:

Name: Ryan Imata

Company: Water Resource Management

From: Eric Tanaka

Date: 9-2-98

Massages: Attached are sheets of information. Please note memo.

Total no. Of pages (including transmittal pages): 7

The original document will not be sent in the mail
If you do not receive all the pages legibly, please call (808) 974-6210
Sending Fax No.: (808) 974-6222
Receiving Fax No.: (808) 587-0219
Fax copy to: (808) 587-0219
September 2, 1998

To: Ryan Imata  
   Water Resource Management, Honolulu

From: Eric Tanaka  
   Engineering Section, Hilo

Re: HSDP Wells

The suspension of the both well drilling permits would not be in order for the well that would be used for the make up water for the deep well would be considered a water well and could be drilled under the jurisdiction of the Water Commission Regulations. The suspension would be only for the deep well for geological exploration.

Attached are information on the pilot well done back in 1993 and the drilling permit issued by the Division of Water & Land Development, Department of Land and Natural Resources. The Spud date of the well was on October 25, 1993 and drilling was completed on December 11, 1993. The total depth of the well (measured depth) at 3464'.

Please not condition #12 of the drilling permit. This would call for the Plug and Abandonment of the well after completion of the project.

If there are any questions to any of the above, please feel free to call on me at any time.

Mahalo,
STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
P.O. BOX 621  
HONOLULU, HAWAII 96809

GEOPHYSICAL RESEARCH HOLE DRILLING PERMIT

Hawaii Pilot Hole  
Waiakea, South Hilo, Hawaii

TO: University of Hawaii  
School of Ocean & Earth Science & Technology (SOEST)  
2525 Correa Road  
Honolulu, Hawaii 96822

Your application, dated August 25, 1993, for a permit to drill a geophysical research hole on State-owned land located in Waiakea, South Hilo, Hawaii for the purpose of recovering rock core samples and gathering down-hole geophysical data for scientific research, is approved.

Well Designation: Hawaii Pilot Hole  
Location: TMK 2-1-09-1 and 2-1-09-41, Waiakea, South Hilo, Hawaii  
Land Owner: State of Hawaii  
Operator: University of Hawaii, SOEST  
Ground Elevation: 8 +/- ft. Above Mean Sea Level  
Projected Depth: 2,000 to 3,000 +/- ft. True Vertical Depth

Approval is granted in accordance with the following conditions:

1. All work shall be performed in accordance with the requirements and terms of the occupiers of the land; the Drilling and Completion Program submitted with your application; Hawaii Revised Statutes, Chapter 178; and all other applicable statutes, ordinances, rules and regulations of the Federal, State, and Hawaii County governments;

2. The permittee, its successors and assigns shall indemnify, defend and hold the State of Hawaii harmless from and against any loss, liability, claim or demand for property damage, personal injury and death arising out of any act or omission of the applicant, assigns, officers, employees, contractors and agents under this permit or relating to or connected with the granting of this permit;

3. The permittee shall observe and comply with all valid requirements of Federal, State and County authorities and regulations pertaining to lands and permittee's operations including, but not limited to, all water, air, and noise pollution control laws and those relating to the environment;
The well and bottom-hole location shall be located more than 100 feet from the outer boundary of the parcel of land on which the well is situated, or more than 100 feet from a public road, street, or highway dedicated prior to the commencement of drilling, unless modified by the Chairperson upon request;

The permittee shall notify the Division of Water and Land Development (DOWALD), in writing, of the date of the start of drilling operations;

If elevated down-hole temperatures are observed, the permittee shall immediately halt operations and notify DOWALD;

If changes to the proposed drilling program are contemplated, the permittee shall obtain the Chairperson's approval before executing such changes;

When drilling has reached a depth of not more than 50 feet below sea level, the Department's representative shall be notified, with reasonable time allowed for travel to the site, to witness the retrieval of a representative ground water sample and the measurement of the static water level. The permittee shall have the sample analyzed by an independent laboratory and have the results submitted to the Department;

During the use of the well for testing, monitoring, or coring purposes, the well and site shall be properly maintained until the well is plugged and abandoned;

The permittee shall submit to the Chairperson, the results of any exploration, all drilling and testing records, down-hole surveys of the well, bottom-hole location, date of completion, and a survey of the well location and elevation above mean sea level taken by a Hawaii licensed surveyor within six months after completion of the well;

A well completion report, an as-built drawing of the well, and the location of the well plotted on a U.S.G.S. quad map shall be filed with the Department within six months after completion of the well;

If no further work is to be conducted at the site, the well will be either plugged and abandoned with surface restored as near as possible to its original condition, or dedicated to long-term research use as deemed appropriate by the Department; and
(13) This permit shall expire 365 calendar days from the date of issuance.

SEP - 2 1993
Date of Issuance

c: Land Board Members
   Hawaii County Planning Dept.
   DBEDT
   Dept. of Health
   OEQC, DOH
Concrete Conduit

- 4.25 inch diameter Casing

- 3.75 inch Diameter Casing

- 3.0 inch Diameter Hole

+/- 200 ft

+/- 1200 ft

+/- 3000 ft

Figure 3. Drawing showing planned well design.
Figure 2. Drawing showing planned layout of the drilling site and its relationship to the existing topography.
FACSIMILE TRANSMITTAL

To: Eric Tanaka
Company: Land Division
Fax Number: 974-6222
Phone Number: 974-6210

From: Ryan Imata
Date: August 28, 1998
Pages Including Header: 10
Subject: HSDP Wells

Notes/Comments:
REF:CWRM-SS

Mr. Eugene S. Imai
University of Hawaii
Bachman Hall
2444 Dole Street
Honolulu, Hawaii 96822

Dear Mr. Imai:

Well Construction Permit
HSDP Well (Well No. 4203-16)

Enclosed are two (2) copies of your approved Well Construction Permit for the captioned well(s) which authorizes well construction activities but excludes installation work for your permanent pump. As part of the Chairperson's approval, the following special conditions were added and are part of your permit under Permit Condition 12:

Special Conditions

1. Attached for your information is a copy of the Department of Health's (DOH) review comments. Please note DOH's requirements related to discharge of effluent from well drilling and testing activities.

2. The annular space shall be in compliance with the requirements described in Section 2.6d of the Hawaii Well Construction and Pump Installation Standards.

This permit does not authorize work for your permanent pump installation. Approval and issuance of your pump installation permit is contingent upon completed application and information provided to and accepted by Commission staff as required in the Well Construction & Pump Installation Standards (1/23/97) and any special conditions performed under this permit. However, in accordance with the Commission's April 15, 1998 Declaratory Ruling No. DEC-ADM98-G5, which states that:

"Permanent pump installation for capacities between 0-70 gpm and where the proposed use is for private individual needs in non-ground-water management areas may be allowed prior to the final pump installation permit issuance. When required as a condition of the well construction permit, subsequent pumping tests shall validate the acceptability of the permanent pump. The permanent pump installed prior to final pump installation permit issuance is subject to removal if the testing shows that a smaller pump is required to reduce the potential of affecting neighboring wells and localized upconing at the applicant's well."

Date 8/19/98 # of pages 6
To Fax Tanaka From Roy Hardy
Co./Dept. Co. Phone # 587-0274
Fax # 974-6222 Fax #
a permanent pump may be installed prior to the permanent pump installation permit issuance. If you qualify and wish to take advantage of this ruling, please include a written request to install the permanent pump prior to final pump installation permit issuance when you return to us your validated well construction permit.

To validate your permit, please sign and have the contractor sign both permit originals and return one for our files. Also, copies of the aquifer pump test worksheet and the well completion report form are enclosed for your use. Please provide all the information in this packet to your well drilling contractor.

IMPORTANT - The well owner is responsible for all conditions of the permit. This includes ensuring that the well construction contractor, or other party who constructs the well(s), submits a completed Part I of the Well Completion Report form (enclosed) within sixty (60) days after the well construction work is completed. Be advised that you may be subject to fines of up to $1000 per day for any violations of your permit conditions.

If you have any questions, please call the Commission staff at 587-0255.

Aloha,

[Signature]

MICHAELEN D. WILSON
Chairperson

Enclosures
Mr. Eugene S. Imai
University of Hawaii
Bachman Hall
2444 Dole Street
Honolulu, Hawaii 96822

Dear Mr. Imai:

Well Construction Permit
HSDP 3 Well (Well No. 4203-17)

Enclosed are two (2) copies of your approved Well Construction Permit for the captioned well(s) which authorizes well construction activities but excludes installation work for your permanent pump. As part of the Chairperson’s approval, the following special conditions were added and are part of your permit under Permit Condition 12:

Special Conditions

1. Attached for your information is a copy of the Department of Health’s (DOH) review comments. Please note DOH’s requirements related to discharge of effluent from well drilling and testing activities.

2. The annular space shall be in compliance with the requirements described in Section 2.6d of the Hawaii Well Construction and Pump Installation Standards.

This permit does not authorize work for your permanent pump installation. Approval and issuance of your pump installation permit is contingent upon completed application and information provided to and accepted by Commission staff as required in the Well Construction & Pump Installation Standards (1/23/97) and any special conditions performed under this permit. However, in accordance with the Commission’s April 15, 1998 Declaratory Ruling No. DEC-ADM98-G5, which states that:

"Permanent pump installation for capacities between 0-70 gpm and where the proposed use is for private individual needs in non-ground-water management areas may be allowed prior to the final pump installation permit issuance. When required as a condition of the well construction permit, subsequent pumping tests shall validate the acceptability of the permanent pump. The permanent pump installed prior to final pump installation permit issuance is subject to removal if the testing shows that a smaller pump is required to reduce the potential of affecting neighboring wells and localized upconing at the applicant's well."
a permanent pump may be installed prior to the permanent pump installation permit issuance. If you qualify and wish to take advantage of this ruling, please include a written request to install the permanent pump prior to final pump installation permit issuance when you return to us your validated well construction permit.

To validate your permit, please sign and have the contractor sign both permit originals and return one for our files. Also, copies of the aquifer pump test worksheet and the well completion report form are enclosed for your use. Please provide all the information in this packet to your well drilling contractor.

IMPORTANT - The well owner is responsible for all conditions of the permit. This includes ensuring that the well construction contractor, or other party who constructs the well(s), submits a completed Part I of the Well Completion Report form (enclosed) within sixty (60) days after the well construction work is completed. Be advised that you may be subject to fines of up to $1000 per day for any violations of your permit conditions.

If you have any questions, please call the Commission staff at 587-0255.

Aloha,

MICHAEL D. WILSON
Chairperson

Enclosures
WELL CONSTRUCTION PERMIT

HSDP 3 Well, Well No. 4203-17

In accordance with Department of Land and Natural Resources, Commission on Water Resource Management’s Administrative Rules, Section 13-168, entitled “Water Use, Wells, and Stream Diversion Works”, this document permits the construction and testing of HSDP 3 Well (Well No. 4203-17) at Hilo International Airport, Hawaii, TMK 2-1-12, subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97) which include but are not limited to the following:

1. The Chairperson of the Commission on Water Resource Management (Commission), P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work authorized by this permit commences.

2. The well construction permit shall be for construction and testing of the well only. A minimum one-inch diameter monitor tube shall be permanently installed, in a manner acceptable to the Chairperson, to accurately record water levels. The permittee shall coordinate with the Chairperson and conduct a pumping test in accordance with the Standards (a pump testing worksheet is attached). The permittee shall submit to the Chairperson the test results as a basis for supporting an application to install a permanent pump and withdraw water for use. No permanent pump may be installed until a pump installation permit is approved and issued by the Chairperson.

3. In basement ground water, the depth of the well may not exceed one-fourth (1/4) of the theoretical thickness (41 times initial head) of the basal ground water unless otherwise authorized by the Chairperson.

4. The permittee shall incorporate mitigation measures to prevent construction debris from entering the aquatic environment, to schedule work to avoid periods of high rainfall, and to revegetate any cleared areas as soon as possible.

5. In the event that subsurface cultural remains such as artifacts, burials or concentrations of shells or charcoal are encountered during construction, the permittee shall stop work and contact the Department’s Historic Preservation Division (587-0045) immediately.

6. The proposed well construction shall not adversely affect existing or future legal uses of water in the area, including any surface water or established instream flow standards. This permit or the authorization to construct the well shall not constitute a determination of correlative water rights.

7. The following shall be submitted to the Chairperson within sixty (60) days after completion of work:
   b. Elevation (referenced to mean sea level, msl) survey by a Hawaii-licensed surveyor.
   c. As-built sectional drawing of the well.
   d. Plot plan and map showing the exact location of the well.
   e. Complete pumping test records, including time, pumping rate, drawdown, chloride content, and other data.

8. The permittee shall comply with all applicable laws, rules, and ordinances; non-compliance may be grounds for revocation of this permit.

9. The well construction permit application is incorporated into this permit by reference and is subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97).

10. The permit may be revoked if work is not started within six (6) months after the date of approval or if work is suspended or abandoned for six (6) months, unless otherwise specified. The work proposed in the well construction permit application shall be completed within two (2) years from the date of permit approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than three (3) months prior to the date the permit expires. If the commencement date is not met, the Commission may revoke the permit after giving the permittee notice of the proposed action and an opportunity to be heard.

11. If the well is not to be used it must be properly capped. If the well is to be abandoned then the permittee must apply for a well abandonment permit in accordance with §13-168-12(f) prior to any well sealing or plugging work.

12. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

Date of Approval: June 24, 1998
Expiration Date: June 24, 2000

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $1000 per day.

Permittee’s Signature: ___________________________ Date: ___________

Printed Name: ___________________________ Firm or Title: ___________

Driller’s Signature: ___________________________ License #: ___________ Date: ___________

Printed Name: ___________________________ Firm or Title: ___________

Please sign both copies of this permit, return one to the Chairperson, and retain the other for your records.

Attachment

c: USGS
Department of Health/ Safe Drinking Water, Wastewater, and Clean Water Branches
Hawaii Department of Water Supply
Department of Transportation, Airports Division
Mr. Eugene S. Imai  
University of Hawaii  
Bachman Hall  
2444 Dole Street  
Honolulu, Hawaii 96822  

Dear Mr. Imai:  

Well Construction Permit  
HSDP Well (Well No. 4203-16)  

Enclosed are two (2) copies of your approved Well Construction Permit for the captioned well(s) which authorizes well construction activities but excludes installation work for your permanent pump. As part of the Chairperson’s approval, the following special conditions were added and are part of your permit under Permit Condition 12:  

Special Conditions  

1. Attached for your information is a copy of the Department of Health’s (DOH) review comments. Please note DOH’s requirements related to discharge of effluent from well drilling and testing activities.  

2. The annular space shall be in compliance with the requirements described in Section 2.6d of the Hawaii Well Construction and Pump Installation Standards.  

This permit does not authorize work for your permanent pump installation. Approval and issuance of your pump installation permit is contingent upon completed application and information provided to and accepted by Commission staff as required in the Well Construction & Pump Installation Standards (1/23/97) and any special conditions performed under this permit. However, in accordance with the Commission’s April 15, 1998 Declaratory Ruling No. DEC-ADM98-G5, which states that:  

*Permanent pump installation for capacities between 0-70 gpm and where the proposed use is for private individual needs in non-ground-water management areas may be allowed prior to the final pump installation permit issuance. When required as a condition of the well construction permit, subsequent pumping tests shall validate the acceptability of the permanent pump. The permanent pump installed prior to final pump installation permit issuance is subject to removal if the testing shows that a smaller pump is required to reduce the potential of affecting neighboring wells and localized upconing at the applicant’s well.*
a permanent pump may be installed prior to the permanent pump installation permit issuance. If you qualify and wish to take advantage of this ruling, please include a written request to install the permanent pump prior to final pump installation permit issuance when you return to us your validated well construction permit.

To validate your permit, please sign and have the contractor sign both permit originals and return one for our files. Also, copies of the aquifer pump test worksheet and the well completion report form are enclosed for your use. Please provide all the information in this packet to your well drilling contractor.

IMPORTANT - The well owner is responsible for all conditions of the permit. This includes ensuring that the well construction contractor, or other party who constructs the well(s), submits a completed Part I of the Well Completion Report form (enclosed) within sixty (60) days after the well construction work is completed. Be advised that you may be subject to fines of up to $1000 per day for any violations of your permit conditions.

If you have any questions, please call the Commission staff at 587-0255.

Aloha,

[Signature]
MICHAELE D. WILSON
Chairperson

Enclosures
WELL CONSTRUCTION PERMIO
HSDP Well, Well No. 4203-16

In accordance with Department of Land and Natural Resources, Commission on Water Resource Management's Administrative Rules, Section 13-168, entitled "Water Use, Wells, and Stream Diversion Works", this document permits the construction and testing of HSDP Well (Well No. 4203-16) at Hilo International Airport, Hawaii, TMK 2-1-12: 9, subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97) which include but are not limited to the following conditions:

1. The Chairperson of the Commission on Water Resource Management (Commission), P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work authorized by this permit commences.

2. The well construction permit shall be for construction and testing of the well only. A minimum one-inch diameter monitor tube shall be permanently installed, in a manner acceptable to the Chairperson, to accurately record water levels. The permittee shall coordinate with the Chairperson and conduct a pumping test in accordance with the Standards (a pump testing worksheet is attached). The permittee shall submit to the Chairperson the test results as a basis for supporting an application to install a permanent pump and withdraw water for use. No permanent pump may be installed until a pump installation permit is approved and issued by the Chairperson.

3. In basal ground water, the depth of the well may not exceed one-fourth (1/4) of the theoretical thickness (41 times initial head) of the basal ground water unless otherwise authorized by the Chairperson.

4. The permittee shall incorporate mitigation measures to prevent construction debris from entering the aquatic environment, to schedule work to avoid periods of high rainfall, and to revegetate any cleared areas as soon as possible.

5. In the event that subsurface cultural remains such as artifacts, burials or concentrations of shells or charcoal are encountered during construction, the permittee shall stop work and contact the Department's Historic Preservation Division (587-0045) immediately.

6. The proposed well construction shall not adversely affect existing or future legal uses of water in the area, including any surface water or established instream flow standards. This permit or the authorization to construct the well shall not constitute a determination of correlative water rights.

7. The following shall be submitted to the Chairperson within sixty (60) days after completion of work:
   b. Elevation (referenced to mean sea level, msl) survey by a Hawaii-licensed surveyor.
   c. As-built sectional drawing of the well.
   d. Plot plan and map showing the exact location of the well.
   e. Complete pumping test records, including time, pumping rate, drawdown, chloride content, and other data.

8. The permittee shall comply with all applicable laws, rules, and ordinances; non-compliance may be grounds for revocation of this permit.

9. The well construction permit application is incorporated into this permit by reference and is subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97).

10. The permit may be revoked if work is not started within six (6) months after the date of approval or if work is suspended or abandoned for six (6) months, unless otherwise specified. The work proposed in the well construction permit application shall be completed within two (2) years from the date of permit approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than three (3) months prior to the date the permit expires. If the commencement date is not met, the Commission may revoke the permit after giving the permittee notice of the proposed action and an opportunity to be heard.

11. If the well is not to be used it must be properly capped. If the well is to be abandoned then the permittee must apply for a well abandonment permit in accordance with §13-168-12(f) prior to any well sealing or plugging work.

12. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

Date of Approval: June 24, 1998
Expiration Date: June 24, 2000

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $1000 per day.

Permittee's Signature: ___________________________ Date: ____________

Printed Name: ________________________________ Firm or Title: _______________

Driller's Signature: ____________________________ License #: ____________ Date: ____________

Printed Name: ________________________________ Firm or Title: _______________

Please sign both copies of this permit, return one to the Chairperson, and retain the other for your records.

Attachment

c: USGS
Department of Health/ Safe Drinking Water, Wastewater, and Clean Water Branches
Hawaii Department of Water Supply
Department of Transportation, Airports Division
In accordance with Department of Land and Natural Resources, Commission on Water Resource Management's Administrative Rules, Section 13-168, entitled "Water Use, Wells, and Stream Diversion Works", this document permits the construction and testing of HSDP Well (Well No. 4203-16) at Hilo International Airport, Hawaii, TMK 2-1-12: 9, subject to the Hawaii Well Construction & Pump Installation Standards (123/97) which include but are not limited to the following conditions:

1. The Chairperson of the Commission on Water Resource Management (Commission), P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work authorized by this permit commences.

2. The well construction permit shall be for construction and testing of the well only. A minimum one-inch diameter monitor tube shall be permanently installed, in a manner acceptable to the Chairperson, to accurately record water levels. The permittee shall coordinate with the Chairperson and conduct a pumping test in accordance with the Standards (a pump testing worksheet is attached). The permittee shall submit to the Chairperson the test results as a basis for supporting an application to install a permanent pump and withdraw water for use. No permanent pump may be installed until a pump installation permit is approved and issued by the Chairperson.

3. In basal ground water, the depth of the well may not exceed one-fourth (1/4) of the theoretical thickness (41 times initial head) of the basal ground water unless otherwise authorized by the Chairperson.

4. The permittee shall incorporate mitigation measures to prevent construction debris from entering the aquatic environment, to schedule work to avoid periods of high rainfall, and to revegetate any cleared areas as soon as possible.

5. In the event that subsurface cultural remains such as artifacts, burials or concentrations of shells or charcoal are encountered during construction, the permittee shall stop work and contact the Department's Historic Preservation Division (587-0045) immediately.

6. The proposed well construction shall not adversely affect existing or future legal uses of water in the area, including any surface water or established instream flow standards. This permit or the authorization to construct the well shall not constitute a determination of correlative water rights.

7. The following shall be submitted to the Chairperson within sixty (60) days after completion of work:
   b. Elevation (referenced to mean sea level, msl) survey by a Hawaii-licensed surveyor.
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   e. Complete pumping test records, including time, pumping rate, drawdown, chloride content, and other data.

8. The permittee shall comply with all applicable laws, rules, and ordinances; non-compliance may be grounds for revocation of this permit.

9. The well construction permit application is incorporated into this permit by reference and is subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97).

10. The permit may be revoked if work is not started within six (6) months after the date of approval or if work is suspended or abandoned for six (6) months, unless otherwise specified. The work proposed in the well construction permit application shall be completed within two (2) years from the date of approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than three (3) months prior to the date the permit expires. If the commencement date is not met, the Commission may revoke the permit after giving the permittee notice of the proposed action and an opportunity to be heard.

11. If the well is not to be used it must be properly capped. If the well is to be abandoned then the permittee must apply for a well abandonment permit in accordance with §13-168-12(f) prior to any well sealing or plugging work.

12. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

MICHAEL D. WILSON, Chairperson
Commission on Water Resource Management

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $1000 per day.

Permittee's Signature: ________________________________ Date: __________
Printed Name: ________________________________ Firm or Title: ________________________________
Driller's Signature: ________________________________ License #: __________ Date: __________
Printed Name: ________________________________ Firm or Title: ________________________________

Please sign both copies of this permit, return one to the Chairperson, and retain the other for your records.

Attachment
c: USGS
Department of Health/ Safe Drinking Water, Wastewater, and Clean Water Branches
Hawaii Department of Water Supply
Department of Transportation, Airports Division
Mr. Eugene S. Imai
University of Hawaii
Bachman Hall
2444 Dole Street
Honolulu, Hawaii 96822

Dear Mr. Imai:

Well Construction Permit
HSDP 3 Well (Well No. 4203-17)

Enclosed are two (2) copies of your approved Well Construction Permit for the captioned well(s) which authorizes well construction activities but excludes installation work for your permanent pump. As part of the Chairperson’s approval, the following special conditions were added and are part of your permit under Permit Condition 12:

Special Conditions

1. Attached for your information is a copy of the Department of Health’s (DOH) review comments. Please note DOH’s requirements related to discharge of effluent from well drilling and testing activities.

2. The annular space shall be in compliance with the requirements described in Section 2.6d of the Hawaii Well Construction and Pump Installation Standards.

This permit does not authorize work for your permanent pump installation. Approval and issuance of your pump installation permit is contingent upon completed application and information provided to and accepted by Commission staff as required in the Well Construction & Pump Installation Standards (1/23/97) and any special conditions performed under this permit. However, in accordance with the Commission’s April 15, 1998 Declaratory Ruling No. DEC-ADM98-G5, which states that:

"Permanent pump installation for capacities between 0-70 gpm and where the proposed use is for private individual needs in non-ground-water management areas may be allowed prior to the final pump installation permit issuance. When required as a condition of the well construction permit, subsequent pumping tests shall validate the acceptability of the permanent pump. The permanent pump installed prior to final pump installation permit issuance is subject to removal if the testing shows that a smaller pump is required to reduce the potential of affecting neighboring wells and localized upconing at the applicant’s well."
a permanent pump may be installed prior to the permanent pump installation permit issuance. If you qualify and wish to take advantage of this ruling, please include a written request to install the permanent pump prior to final pump installation permit issuance when you return to us your validated well construction permit.

To validate your permit, please sign and have the contractor sign both permit originals and return one for our files. Also, copies of the aquifer pump test worksheet and the well completion report form are enclosed for your use. Please provide all the information in this packet to your well drilling contractor.

IMPORTANT - The well owner is responsible for all conditions of the permit. This includes ensuring that the well construction contractor, or other party who constructs the well(s), submits a completed Part I of the Well Completion Report form (enclosed) within sixty (60) days after the well construction work is completed. Be advised that you may be subject to fines of up to $1000 per day for any violations of your permit conditions.

If you have any questions, please call the Commission staff at 587-0255.

Aloha,

[Signature]

MICHAEL D. WILSON
Chairperson

Enclosures
WELL CONSTRUCTION PERMIT
HSDP 3 Well, Well No. 4203-17

In accordance with Department of Land and Natural Resources, Commission on Water Resource Management's Administrative Rules, Section 13-168, entitled "Water Use, Wells, and Stream Diversion Works", this document permits the construction and testing of HSDP 3 Well (Well No. 4203-17) at Hilo International Airport, Hawaii, TMK 2-1-12: 9, subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97) which include but are not limited to the following conditions:

1. The Chairperson of the Commission on Water Resource Management (Commission), P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work authorized by this permit commences.

2. The well construction permit shall be for construction and testing of the well only. A minimum one-inch diameter monitor tube shall be permanently installed, in a manner acceptable to the Chairperson, to accurately record water levels. The permittee shall coordinate with the Chairperson and conduct a pumping test in accordance with the Standards (a pump testing worksheet is attached). The permittee shall submit to the Chairperson the test results as a basis for supporting an application to install a permanent pump and withdraw water for use. No permanent pump may be installed until a pump installation permit is approved and issued by the Chairperson.

3. In basal ground water, the depth of the well may not exceed one-fourth (1/4) of the theoretical thickness (41 times initial head) of the basal ground water unless otherwise authorized by the Chairperson.

4. The permittee shall incorporate mitigation measures to prevent construction debris from entering the aquatic environment, to schedule work to avoid periods of high rainfall, and to revegetate any cleared areas as soon as possible.

5. In the event that subsurface cultural remains such as artifacts, burials or concentrations of shells or charcoal are encountered during construction, the permittee shall stop work and contact the Department's Historic Preservation Division (587-0045) immediately.

6. The proposed well construction shall not adversely affect existing or future legal uses of water in the area, including any surface water or established instream flow standards. This permit or the authorization to construct the well shall not constitute a determination of correlative water rights.

7. The following shall be submitted to the Chairperson within sixty (60) days after completion of work:
   b. Elevation (referenced to mean sea level, msl) survey by a Hawaii-licensed surveyor.
   c. As-built sectional drawing of the well.
   d. Plot plan and map showing the exact location of the well.
   e. Complete pumping test records, including time, pumping rate, drawdown, chloride content, and other data.

8. The permittee shall comply with all applicable laws, rules, and ordinances; non-compliance may be grounds for revocation of this permit.

9. The well construction permit application is incorporated into this permit by reference and is subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97).

10. The permit may be revoked if work is not started within six (6) months after the date of approval or if work is suspended or abandoned for six (6) months, unless otherwise specified. The work proposed in the well construction permit application shall be completed within two (2) years from the date of permit approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than three (3) months prior to the date the permit expires. If the commencement date is not met, the Commission may revoke the permit after giving the permittee notice of the proposed action and an opportunity to be heard.

11. If the well is not to be used it must be properly capped. If the well is to be abandoned then the permittee must apply for a well abandonment permit in accordance with §13-168-12(i) prior to any well sealing or plugging work.

12. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

Date of Approval: June 24, 1998
Expiration Date: June 24, 2000

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $1000 per day.

Permittee's Signature: [Signature]
Date: [Signature]

Printed Name: Eugene S. Imai
Firm or Title: University of Hawaii

Driller's Signature: [Signature]
License #: 5058
Date: 2/24/99

Printed Name: Blaise Clay
Firm or Title: Water Resources International

Please sign both copies of this permit, return one to the Chairperson, and retain the other for your records.

Attachment c:
USGS
Department of Health/ Safe Drinking Water, Wastewater, and Clean Water Branches
Hawaii Department of Water Supply
Department of Transportation, Airports Division
WELL CONSTRUCTION PERMIT
HSDP Well, Well No. 4203-16

In accordance with Department of Land and Natural Resources, Commission on Water Resource Management's Administrative Rules, Section 13-158, entitled "Water Use, Wells, and Stream Diversion Works", this document permits the construction and testing of HSDP Well (Well No. 4203-16) at Hilo International Airport, Hawaii, TMK 2-1-12: 9, subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97) which include but are not limited to the following conditions:

1. The Chairperson of the Commission on Water Resource Management (Commission), P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work authorized by this permit commences.

2. The well construction permit shall be for construction and testing of the well only. A minimum one-inch diameter monitor tube shall be permanently installed, in a manner acceptable to the Chairperson, to accurately record water levels. The permittee shall coordinate with the Chairperson and conduct a pumping test in accordance with the Standards (a pump testing worksheet is attached). The permittee shall submit to the Chairperson the test results as a basis for supporting an application to install a permanent pump and withdraw water for use. No permanent pump may be installed until a pump installation permit is approved and issued by the Chairperson.

3. In basinal ground water, the depth of the well may not exceed one-fourth (1/4) of the theoretical thickness (41 times initial head) of the basinal ground water unless otherwise authorized by the Chairperson.

4. The permittee shall incorporate mitigation measures to prevent construction debris from entering the aquatic environment, to schedule work to avoid periods of high rainfall, and to revegetate any cleared areas as soon as possible.

5. In the event that subsurface cultural remains such as artifacts, burials or concentrations of shells or charcoal are encountered during construction, the permittee shall stop work and contact the Department's Historic Preservation Division (587-0045) immediately.

6. The proposed well construction shall not adversely affect existing or future legal uses of water in the area, including any surface water or established instream flow standards. This permit or the authorization to construct the well shall not constitute a determination of correlative water rights.

7. The following shall be submitted to the Chairperson within sixty (60) days after completion of work:
   b. Elevation (referenced to mean sea level, msl) survey by a Hawaii-licensed surveyor.
   c. As-built sectional drawing of the well.
   d. Plot plan and map showing the exact location of the well.
   e. Complete pumping test records, including time, pumping rate, drawdown, chloride content, and other data.

8. The permittee shall comply with all applicable laws, rules, and ordinances; non-compliance may be grounds for revocation of this permit.

9. The well construction permit application is incorporated into this permit by reference and is subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97).

10. The permit may be revoked if work is not started within six (6) months after the date of approval or if work is suspended or abandoned for six (6) months, unless otherwise specified. The work proposed in the well construction permit application shall be completed within two (2) years from the date of permit approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than three (3) months prior to the date the permit expires. If the commencement date is not met, the Commission may revoke the permit after giving the permittee notice of the proposed action and an opportunity to be heard.

11. If the well is not to be used it must be properly capped. If the well is to be abandoned then the permittee must apply for a well abandonment permit in accordance with §13-158-12(l) prior to any well sealing or plugging work.

12. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

Date of Approval: June 24, 1998
Expiration Date: June 24, 2000

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $1000 per day.

Permittee's Signature: _______________________________ Date: ____________
Printed Name: _______________________________ Firm or Title: _______________________________

Driller's Signature: _______________________________ License #: ____________ Date: ____________
Printed Name: _______________________________ Firm or Title: _______________________________

Please sign both copies of this permit, return one to the Chairperson, and retain the other for your records.

Attachment
C: USGS
Department of Health/ Safe Drinking Water, Wastewater, and Clean Water Branches
Hawaii Department of Water Supply
Department of Transportation, Airports Division
WELL CONSTRUCTION PERMIT

HSDP 3 Well, Well No. 4203-17

In accordance with Department of Land and Natural Resources, Commission on Water Resource Management’s Administrative Rules, Section 13-168, entitled “Water Use, Wells, and Stream Diversion Works”, this document permits the construction and testing of HSDP 3 Well (Well No. 4203-17) at Hilo International Airport, Hawaii, TMK 2-1-12: 9, subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97) which include but are not limited to the following conditions:

1. The Chairperson of the Commission on Water Resource Management (Commission), P.O. Box 621, Honolulu, HI 96809, shall be notified, in writing, at least two (2) weeks before any work authorized by this permit commences.

2. The well construction permit shall be for construction and testing of the well only. A minimum one-inch diameter monitor tube shall be permanently installed, in a manner acceptable to the Chairperson, to accurately record water levels. The permittee shall coordinate with the Chairperson and conduct a pumping test in accordance with the Standards (a pump testing worksheet is attached). The permittee shall submit to the Chairperson the test results as a basis for supporting an application to install a permanent pump and withdraw water for use. No permanent pump may be installed until a pump installation permit is approved and issued by the Chairperson.

3. In basal ground water, the depth of the well may not exceed one-fourth (1/4) of the theoretical thickness (41 times initial head) of the basal ground water unless otherwise authorized by the Chairperson.

4. The permittee shall incorporate mitigation measures to prevent construction debris from entering the aquatic environment, to schedule work to avoid periods of high rainfall, and to revegetate any cleared areas as soon as possible.

5. In the event that subsurface cultural remains such as artifacts, burials or concentrations of shells or charcoal are encountered during construction, the permittee shall stop work and contact the Department’s Historic Preservation Division (587-0045) immediately.

6. The proposed well construction shall not adversely affect existing or future legal uses of water in the area, including any surface water or established instream flow standards. This permit or the authorization to construct the well shall not constitute a determination of correlative water rights.

7. The following shall be submitted to the Chairperson within sixty (60) days after completion of work:
   b. Elevation (referenced to mean sea level, msl) survey by a Hawaii-licensed surveyor.
   c. As-built sectional drawing of the well.
   d. Plot plan and map showing the exact location of the well.
   e. Complete pumping test records, including time, pumping rate, drawdown, chloride content, and other data.

8. The permittee shall comply with all applicable laws, rules, and ordinances; non-compliance may be grounds for revocation of this permit.

9. The well construction permit application is incorporated into this permit by reference and is subject to the Hawaii Well Construction & Pump Installation Standards (1/23/97).

10. The permit may be revoked if work is not started within six (6) months after the date of approval or if work is suspended or abandoned for six (6) months, unless otherwise specified. The work proposed in the well construction permit application shall be completed within two (2) years from the date of permit approval, unless otherwise specified. The permit may be extended by the Chairperson upon a showing of good cause and good-faith performance. A request to extend the permit shall be submitted to the Chairperson no later than three (3) months prior to the date the permit expires. If the commencement date is not met, the Commission may revoke the permit after giving the permittee notice of the proposed action and an opportunity to be heard.

11. If the water is not to be used it must be properly capped. If the well is to be abandoned then the permittee must apply for a well abandonment permit in accordance with §13-158-12(f) prior to any well sealing or plugging work.

12. Special conditions in the attached cover transmittal letter are incorporated herein by reference.

Date of Approval: June 24, 1998
Expiration Date: June 24, 2000

I have read the conditions and terms of this permit and understand them. I accept and agree to meet these conditions as a prerequisite and underlying condition of my ability to proceed. I also understand that non-compliance with any permit condition may be grounds for revocation and fines of up to $1000 per day.

Permittee’s Signature: ___________________________ Date: __________

Printed Name: ___________________________ Firm or Title: __________

Driller’s Signature: ___________________________ License #: __________ Date: __________

Printed Name: ___________________________ Firm or Title: __________

Please sign both copies of this permit, return one to the Chairperson, and retain the other for your records.

Attachment:

C: USGS
Department of Health/ Safe Drinking Water, Wastewater, and Clean Water Branches
Hawaii Department of Water Supply
Department of Transportation, Airports Division
WELL CONSTRUCTION   □ PUMP INSTALLATION PERMIT FOR:  HSDE wells 4202-202

ATTACHMENTS FOR WELL CONSTRUCTION PERMIT:
1 COVER LETTER
2 PERMIT (2x) ✓
3 PUMP TEST ✓
4 DOH COMMENTS ✓
5 WCR FORM

TO BE SENT TO APPLICANT
FOR OFFICE USE ONLY

ATTACHMENTS FOR PUMP INSTALLATION PERMIT:
1 COVER LETTER
2 PERMIT (2x)
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## SECTION 1: WELL LOCATION INFORMATION

<table>
<thead>
<tr>
<th>Island</th>
<th>Island HAWAII</th>
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<tbody>
<tr>
<td>Aquifer System</td>
<td>NE MAUNA LOA</td>
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<tr>
<td>Aquifer Sector</td>
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<tr>
<th>Proposed Use</th>
<th>Other</th>
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<tr>
<td>Proposed Withdrawal</td>
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<tr>
<td>System Sustainable Yield</td>
<td>347</td>
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## SECTION 2: WELL SECTION DATA (enter data in grey cells only)

<table>
<thead>
<tr>
<th>Elevation at top of casing</th>
<th>ft., m.s.l.</th>
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<tbody>
<tr>
<td>Ground Elevation</td>
<td>ft., m.s.l.</td>
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<tr>
<td>Cement Grout</td>
<td>ft.</td>
</tr>
<tr>
<td>Rock Packing</td>
<td>in.</td>
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<tr>
<td>Hole Diameter</td>
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<td>Total Depth</td>
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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Calculated Aquifer Thickness</td>
<td>287 ft.</td>
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| County Water Supply (Y/N ?) |  

<table>
<thead>
<tr>
<th>Solid Casing Material Designation</th>
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<td>Openings</td>
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<tr>
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<th>Annular Space</th>
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Mr. Eugene S. Imai
University of Hawaii
Bachman Hall
2444 Dole Street
Honolulu, HI 96822

Dear Mr. Imai:

**Well Construction / Pump Installation Permit Application for Well No. 4203-16 and 17**

We acknowledge receipt, on June 2, 1998, of your completed well construction/pump installation permit application for the HSDP Wells (Well No. 4203-16 and 17). You can expect your application to be processed within ninety (90) days from this date.

For your information, the process of constructing a well is normally regulated and permitted in two (2) steps. First, a well construction permit is issued for drilling and testing purposes only. Based upon information provided by you through a Well Completion Report Part 1 (Well Construction), a pump installation permit (upon completed application) may then be issued to authorize pump work. If a pump is installed then a Well Completion Report Part 2 (Pump Installation) is required.

If you have any questions about your permit application, please contact Mr. Ryan Imata of the Commission staff at 587-0255.

Sincerely,

TIMOTHY E. JOHNS
Deputy Director

RI:ss
<p>| WELL NO. | WELL NAME       | AQUIF CODE | OWNER/USER | YEAR DRILLED | LATITUDE | LONGITUDE | AQUIF | TYPE | TOTAL DEPTH | BOTTOM SOLID CASING | BUMM PERF CASING | BOTTOM OF HOLE | STATIC HEAD | CL. TEMP | SPECIFIC CAPACITY | INSTALLED CAPACITY | NORTH | SOUTH | EAST | SOUTH | ZONE |
|----------|-----------------|------------|------------|---------------|-----------|-----------|-------|------|-------------|---------------------|------------------|---------------|-------------|----------|----------|-------------------|-------------------|-------|-------|------|-------|-------|
| 4202-01  | HILO AIRPORT    | 80401      | HAWAII DWS | 1944          | 194248    | 1550245   | PER   | 16   | 76          | -17                 | 4                | 5             | 64          | 4        | 4        | UNU               | UNU               | LOS   | LOS   | LOS  | LOS   | LOS  |
| 4202-02  | HILO AIRPORT    | 80401      | HELCO      | 1944          | 194240    | 1550252   | PER   | 5    | 55          | 16                  | 5                | 4             | 1000        | 4        | 1000     | UNU               | UNU               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-01  | WAIKEA TH 1     | 80401      | HELCO      | 1960          | 194228    | 1550353   | PER   | 5    | 54          | 14                  | 6.7              | 4             | 21.1        | 36       | 36       | UNU               | UNU               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-02  | WAIKEA TH 2     | 80401      | HELCO      | 1960          | 194223    | 1550352   | 5      | 55   | 41          | -14                 | 9.1              | 6             | 21.1        | 83       | 83       | LOS               | LOS               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-03  | WAIKEA TH 3     | 80401      | HELCO      | 1960          | 194230    | 1550348   | 5      | 56   | 41          | -15                 | 5.8              | 4             | 21.1        | 250      | 250      | UNU               | UNU               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-04  | WAIKEA 4        | 80401      | HELCO      | 1961          | 194222    | 1550351   | PER   | 16   | 201         | -13                 | -154             | 7.06          | 22          | 20.0     | 12500    | SLD               | SLD               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-06  | HILL UNIT 5A    | 80401      | HELCO      | 1965          | 194222    | 1550350   | 29     | 200  | 50          | -4                  | -150             | 20.0          | 6.480       | IND      | IND      | IND               | IND               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-06  | HILL UNIT 5B    | 80401      | HELCO      | 1965          | 194223    | 1550349   | 29     | 200  | 50          | -4                  | -150             | 6.5           | 19.9        | 1000     | 6.480    | IND               | IND               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-07  | HILL UNIT 5C    | 80401      | HELCO      | 1965          | 194224    | 1550350   | 29     | 585  | 50          | -150                | -535             | 6.480         | 16.8        | IND      | IND      | IND               | IND               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-08  | KANOELEHUA DISP | 80401      | HELCO      | 1965          | 194228    | 1550350   | DUG   | 192  | 33          | 31                  | 6                | 6             | DIS         | .864     | IND      | IND               | IND               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-09  | HILL UNIT 6A    | 80401      | HELCO      | 1974          | 194223    | 1550347   | ROT   | 32   | 210         | -20                 | -155             | 6             | 9.000       | IND      | IND      | IND               | IND               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-10  | HILL UNIT 6B    | 80401      | HELCO      | 1973          | 194222    | 1550347   | ROT   | 32   | 210         | -20                 | -155             | 6             | 20.0        | 1743     | 9.000    | IND               | IND               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-11  | HILL UNIT 6C    | 80401      | HELCO      | 1974          | 194223    | 1550346   | DUG   | 72   | 20          | 43                  | 23               | 6             | 1349        | DIS      | DIS      | DIS               | DIS               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-12  | HELCO KAN 6-4   | 80401      | HELCO      | 1974          | 194222    | 1550346   | ROT   | 30   | 210         | -31                 | -161             | 6             | 60000       | IND      | IND      | IND               | IND               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-13  | GLOVER QUARRY A | 80401      | JAS GLOVER LTD | 1948          | 194244    | 1550344   | DUG   | 72   | 25          | 23                  | -2               | .864         | IND         | IND      | IND      | IND               | IND               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-14  | GLOVER QUARRY B | 80401      | JAS GLOVER LTD | 1948          | 194245    | 1550342   | DUG   | 72   | 25          | 23                  | -2               | .504         | IND         | IND      | IND      | IND               | IND               | SLD   | SLD   | SLD  | SLD   | SLD  |
| 4203-15  | WAIKEA         | 80401      | HAWAIIAN HOST | 1987          | 194216    | 1550336   | PER   | 8    | 130         | 81                   | -19              | 49            | 8.75        | 19.4     | IND      | IND               | IND               | SLD   | SLD   | SLD  | SLD   | SLD  |</p>
<table>
<thead>
<tr>
<th>Well No.</th>
<th>Well Name</th>
<th>Aquifer Code</th>
<th>Owner/User</th>
<th>Aquifer Code</th>
<th>Owner/User</th>
<th>Year Drilled</th>
<th>Latitude</th>
<th>Longitude</th>
<th>Type</th>
<th>Case Dia in.</th>
<th>Total Depth ft</th>
<th>Ground</th>
<th>Bottom Solid Casing</th>
<th>Bottom Perf Casing</th>
<th>Bottom Hole Static Head</th>
<th>CI</th>
<th>Temp</th>
<th>Specific Capacity</th>
<th>Installed Capacity</th>
<th>Use</th>
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MEMORANDUM

To: Mr. Michael Wilson
   Chair
   Board of Land and Natural Resources

VIA: Mr. Roy Hardy
     591 Ala Moana Blvd.
     Honolulu, HI 96814

From: Eugene S. Imai
      Senior Vice President for Administration

Subject: Well Drilling Permits for the Hawaii Scientific Drilling Project

Enclosed for your review and approval are well drilling permits and a pump installation permit for two wells that will be drilled as part of the Hawaii Scientific Drilling Project. The first well is a shallow water well that will be used as a source of non-potable drilling water for the deeper well which will be a geophysical observation well. Both wells are located in Hilo, Hawaii on a parcel of land within the property managed by the Hilo International Airport of the Hawaii Department of Transportation.

This project will be under the management of the University of Hawaii. The contact person for the project is Dr. Donald Thomas, the Principal Investigator for the Hawaii Scientific Drilling Project. Questions may be directed to him at 956-6482.

Thank you for your consideration of these applications.

Enclosure
APPLICATION FOR PERMIT

1. APPLICANT: (may be a, b, or c, but all must be filled in)
   (a) WELL OWNER
      Firm/Name: University of Hawaii
      Contact Person: Donald Thomas
      Phone: 956-6482
      Address: HISP, 2525 Correa Road
               Honolulu, HI 96822

   (b) LANDOWNER
      Firm/Name: DoT, Airport Division
      Contact Person:
      Phone: 
      Address:

   (c) CONTRACTOR
      Firm/Name: See attached
      Phone: 
      Contractor's C-57 License No:
      Address:

2. WELL LOCATION/NAME: HISP-3 AUS 2
   Island: Hawaii
   Address: Hilo International Airport
   Tax Map Key: 2-1-12:9
   (Attach a USGS map, scale 1"=2000, and a property tax map showing well location referenced to established property boundaries.)

3. (a) PROPOSED WORK: Drill New Well
   - * Alter Location
   - Modify Existing Well
   - Redrill
   - Deepen
   - * Abandon/Seal
   - Install New Pump
   - Replace Pump
   - Modify Pump
   - Be sure to complete and submit well abandonment report upon completion of work.

   (b) WELL TYPE:
   - Dug
   - Bored
   - Driven
   - Drilled
   - Radial
   - Is this well a part of a battery of wells? Yes
   - No
   (Briefly describe and fill in the diagram on the back of this form.)

4. PROPOSED PUMP INFORMATION: Rated Pump Capacity: 300 gpm gallons per minute
   Pump Type:
   - Deep Well Turbine
   - Submersible
   - Centrifugal
   - Rotary
   - Rotary-Displacement
   - Rotary-Gear
   Motor:
   - Propeller
   - Reciprocating
   - Impulse
   - Diesel
   - Gas
   - Electric, rated horsepower of __

5. PROPOSED USE:
   - Municipal (including hotels, stores, etc.)
   - Domestic (individual, noncommercial water sys.)
   - Irrigation (crop)
   - State Land Use District:
     - Urban
     - Agriculture
   - County Zoning (describe):
   - Other (explain)
   - Military
   - Industrial
   - Rural
   - Conservation
   (If more space is needed, continue below under remarks, explanations.)

6. (a) PROPOSED AMOUNT OF WITHDRAWAL: ≤ 450,000 gallons per day
   (b) METHOD OF FLOW MEASUREMENT:
   - Flow-meter
   - Open-pipe
   - Orifice Plate
   - Weir

7. PENDING ACTIONS:
   - CDUA
   - SMA
   - EIS
   - EA
   - NONE
   - Other(explain)

8. REMARKS, EXPLANATIONS: See attached

NOTE: Signing below indicates that the applicant understands that, if the permit requested is granted by the Commission on Water Resource Management, the proposed work is to be completed within 2 years of the approval date. In addition, the contractor shall submit to the Commission a well completion report, well abandonment report, or both, within 30 days after completion date of the permitted work. The applicant also understands that monthly water use data shall be submitted to the Commission. The applicant further understands that approval of the proposed permit shall not constitute a determination of correlative water rights and shall not guarantee the pump capacity or future use up to the permitted pump capacity.

Well Owner: University of Hawaii
Signature: __________________________
Date: __________________

Landowner: DoT, Airport Division
Signature: __________________________
Date: __________________

Contractor: __________________________
Signature: __________________________
Date: __________________

For Official Use Only:
Date Received:
Date Accepted:
Field Checked By:
Date:

Latitude: __________________
Longitude: __________________
Aquifer System Name: __________________
State Well No: __________________
Remarks, Explanations (cont’d):

Elevation at top of casing
26 ft., msl.

Cement Grout: to 26 ft.

Rock Packing to 40 ft.

Hole Diameter: 16 in.

Total Depth 45 ft.

Ground Elevation: 24 ft., msl*

Solid Casing:
Material: carbon steel
Length: 28 ft.
Diameter: 12 in.
Wall thickness: 0.25 in.

Openings: sq. in./L.F.

Open Hole:
Length: 5 ft.
Diameter: 18 in.

9. PROPOSED WELL SECTION

*Approximate elevation at time of filing application. Ground elevation above mean sea level (msl) by a surveyor licensed by the State must be submitted at start of construction. Final elevations of well components shall be submitted in the well completion/well abandonment reports.
8. REMARKS, EXPLANATIONS:

CONTRACTOR
Selection of the drilling contractor will be by competitive bid. Requests for bids will be issued after a number of administrative and regulatory issues are resolved and we have a confirmed starting date for the drilling project. Currently, our estimate of a start date is in the fourth quarter of 1998.

WELL LOCATION
The well site is located in an abandoned quarry that is on State of Hawaii Department of Transportation lands that are managed by the Hilo International Airport; the land is zoned Urban and has a Limited Industrial use classification. Use of these lands will be under a Revocable Permit issued by the Airports Division; application for the Revocable Permit has been made to the Department of Transportation and is pending. Use of Airport lands for the proposed purpose has been approved by the Board of Land and Natural Resources.

The specific site of the well within the quarry has not yet been determined and will be defined after the issuance of the revocable permit specifying the parcel of land in the quarry that will be made available to us and after site clearing has been completed.

USE OF THE WELL
The purpose of the subject well will be for the production of non-potable water that is to be used in the drilling of a deep geophysical observation hole. The maximum water usage rate for drilling is estimated to be about 300 gpm during short intervals of hole flushing while we are “opening” the deep hole. The quality of the water, in terms of salinity, is not a significant consideration since the deeper hole will be drilled into saltwater saturated basalts and, hence, the drilling fluids will have to be tolerant of high salt concentrations.

After drilling operations are complete, the well will be used in a seismic experiment for the installation of a seismic source (an air gun) that will enable us to better characterize the subsurface volcanic structure around the site. The need for the installation of the seismic source is the controlling factor in the selection of the well diameter.

IMPACT ON WATER SUPPLIES
The location of the project site is below the Underground Injection Control line and, hence, the likely impact of this well on potable water supplies is insignificant. Further, there are neither private nor municipal water wells currently in operation in close proximity to the proposed well sites.
8. REMARKS, EXPLANATIONS: (cont.)

ADMINISTRATIVE AND REGULATORY ACTIONS
The following administrative or regulatory actions have been completed, are pending, or will be applied for:

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<th>Action</th>
<th>Status</th>
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<tr>
<td>Environmental Assessment</td>
<td>Completed, Finding of No Significant Impact</td>
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<td>Approved</td>
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<td>Submitted, pending</td>
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<td>Community Noise Variance</td>
<td>Submitted, pending</td>
</tr>
<tr>
<td>Well Drilling Permit (deep hole)</td>
<td>Submitted, pending</td>
</tr>
<tr>
<td>Well Drilling Permit (this application)</td>
<td>Submitted, pending</td>
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<tr>
<td>Hawaii County Plan Approval</td>
<td>To be submitted</td>
</tr>
<tr>
<td>FAA Notice of Proposed Construction</td>
<td>To be Submitted</td>
</tr>
</tbody>
</table>

WELL DISPOSITION
The planned lifetime of the drilling program is approximately five years. At the conclusion of drilling, the project site will be returned to the control of the Airports Division and the ownership of the well will be transferred to them should they so desire. If the Airports Division has no foreseeable use for the well, then it will be plugged and abandoned as per instructions from Department of Land and Natural Resources.
Figure 6 Diagram showing hole casing program and proposed phasing of the drilling effort
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 2 FEET
APPLICATION FOR PERMIT

☐ Well Construction  ☐ Pump Installation

1. APPLICANT:
   (a) WELL OWNER
      Firm/Name: University of Hawaii
      Contact Person: Donald Thomas Ph: 956-6482
      Address: HIGP, 2525 Correa Road
               Honolulu, HI 96822
   (b) LANDOWNER
      Firm/Name: DOT, Airport Division
      Contact Person
      Address
   (c) CONTRACTOR
      Firm/Name
      Ph:
      Address

2. WELL LOCATION/NAME:
   Island: Hawaii
   Address: Hilo International Airport
   (Attach a USGS map, scale 1"=2000', and a property tax map showing well location referenced to established property boundaries.)

3. (a) PROPOSED WORK:
   (b) WELL TYPE:

4. PROPOSED PUMP INFORMATION:
   Rated Pump Capacity:
   gallons per minute

5. PROPOSED USE:
   Military
   Industrial
   Other (explain)
   (Briefly describe and fill in the diagram on the back of this form.)

6. (a) PROPOSED AMOUNT OF WITHDRAWAL:
   gallons per day
   (b) METHOD OF FLOW MEASUREMENT:

7. PENDING ACTIONS:
   CDUA  SMA  EIS  EA  NONE  Other(explain)

8. REMARKS, EXPLANATIONS:
   see attached

NOTE: Signing below indicates that the applicant understands that, if the permit requested is granted by the Commission on Water Resource Management, the proposed work is to be completed within two (2) years of the approval date. In addition, the contractor shall submit to the Commission a well completion report, and abandonment report, or both, within 30 days after completion date of the permitted work. The applicant also understands that monthly water use data shall be submitted to the Commission. The applicant further understands that approval of the proposed permit shall not constitute a determination of correlative water rights and shall not guarantee the pump capacity or future use up to the permitted pump capacity.

Well Owner: University of Hawaii
Signature
Date
Landowner: DOT/Airport Division
Signature
Date
Contractor
Signature
Date

For Official Use Only:
Date Received
Date Accepted
Field Checked By
Date
Longitude
Latitude
Aquifer System Name
State Well No.

5/24/92 WCM
Remarks, Explanations (cont'd):

9. PROPOSED WELL SECTION

See attached

Elevation at top of casing

Ground Elevation: _____ ft., msl.

Cement Grout: _____ ft.

Rock Packing: _____ ft.

Solid Casing:

Material
Length
Diameter
Wall thickness

Hole Diameter: _____ in.

Total Depth: _____ ft.

Casing:

[Check] Perforated
[ ] Screen

Material
Length
Diameter
Wall thickness

Openings: _____ sq. in./L.F.

Open Hole:

Length
Diameter

*Approximate elevation at time of filing application. Ground elevation above mean sea level (msl) by a surveyor licensed by the State must be submitted at start of construction. Final elevations of well components shall be submitted in the well completion/well abandonment reports.
## APPLICATION FOR PERMIT

**Instructions:** Please print in ink or type and send completed application with attachments to the Commission on Water Resource Management, P.O. Box 621, Honolulu, Hawaii 96820. Application must be accompanied by a non-refundable filing fee of $25.00 payable to the Dept. of Land and Natural Resources. The Commission may not accept incomplete applications. For assistance, call the Regulation Branch at 957-0225.

### 1. APPLICANT (may be a, b, or c, but all must be filled in)

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<th>(b) LANDOWNER</th>
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<td>Contact Person: Donald Thomas</td>
<td>Contact Person:</td>
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<td>Phone: 956-6482</td>
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<td>Address: 2525 Correa Road, Honolulu, HI 96822</td>
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### (c) CONTRACTOR

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### 2. WELL LOCATION/NAME: HSDP-3

**Island:** Hawaii

**Address:** Hilo International Airport

**Tax Map Key:** 2-1-1-2:9

(Attach a USGS map, scale 1”=2000', and a property tax map showing well location referenced to established property boundaries.)

### 3. (a) PROPOSED WORK: Drill New Well

- [ ] * Alter Location
- [ ] Modify Existing Well
- [ ] * Redrill
- [ ] Install New Pump
- [ ] Replace Pump
- [ ] Modify Pump

* Be sure to complete and submit well abandonment report upon completion of work.

(b) WELL TYPE: Dug

- [ ] Bored
- [ ] Driven
- [ ] Drilled
- [ ] Radial

Is this well a part of a battery of wells? Yes

- [ ] No

(Briefly describe and fill in the diagram on the back of this form.)

### 4. PROPOSED PUMP INFORMATION: Rated Pump Capacity: 300 gpm

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### 5. PROPOSED USE:

- [ ] Municipal (including hotels, stores, etc.)
- [ ] Military
- [ ] Domestic (individual, noncommercial water sys.)
- [ ] Industrial
- [ ] Irrigation (crop)
- [ ] Other (explain)

**State Land Use District:** Urban

**County Zoning (describe):**

(if more space is needed, continue below under remarks, explanations.)

### 6. (a) PROPOSED AMOUNT OF WITHDRAWAL: 450,000 gallons per day

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(b) METHOD OF FLOW MEASUREMENT:

- [ ] Flow-meter
- [ ] Open-pipe
- [ ] Office Plate
- [ ] Weir

### 7. PENDING ACTIONS:

- [ ] CDUA
- [ ] SMA
- [ ] EIS
- [ ] EA
- [ ] NONE
- [ ] Other (explain)

### 8. REMARKS, EXPLANATIONS:

See attached

---

**Well Owner:** University of Hawaii

**Landowner:** DOT/Airport Division

**Contractor:**

<table>
<thead>
<tr>
<th>Signature</th>
<th>Date</th>
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<td>Signature:</td>
<td>Date:</td>
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For Official Use Only:

**Date Received:**
**Date Accepted:**
**Field Checked By:**
**Date:**
**Longitude:**
**Aquifer System Name:**
**State Well No.:**

6/24/92 WCR F.
9. PROPOSED WELL SECTION

Elevation at top of casing: 26 ft., msl.

Ground Elevation: 24 ft., msl*

Cement Grout: to 26 ft.

Rock Packing: to 40 ft.

Hole Diameter: 16 in.

Total Depth: 45 ft.

Solid Casing:
- Material: carbon steel
- Length: 28 ft.
- Diameter: 12 in.
- Wall thickness: 0.25 in.

Casing:
- Perforated: Yes
- Screen: No
- Material: carbon steel
- Length: 14 ft.
- Diameter: 12 in.
- Wall thickness: 0.25 in.
- Openings: __ sq. in./L.F.

Open Hole:
- Length: 5 ft.
- Diameter: 18 in.

---

*Approximate elevation at time of filing application. Ground elevation above mean sea level (msl) by a surveyor licensed by the State must be submitted at start of construction. Final elevations of well components shall be submitted in the well completion/well abandonment reports.
8. REMARKS, EXPLANATIONS:

CONTRACTOR
Drilling of the deep geophysical observation hole will be under the direction of a drilling engineer who has been selected on the basis of his specialized expertise in managing deep wireline coring programs. The technology is highly specialized, being used primarily for minerals exploration, and is very rarely used to the depths of the planned hole; there are fewer than a dozen people in the world who have managed wireline core drilling to depths greater than 4 kilometers using the proposed technology. In order to complete this project, we have had a hybrid core drilling system fabricated under the direction of our drilling engineer. On the basis of the highly specialized nature of the project and the equipment to be used for coring, we have requested an exemption from the Hawaii Contractors Licensing Law, under Chapter 442-2(9) "Any project or operation where it is determined by the board that less than ten persons are qualified to perform the work in question and that the work does not pose a potential danger to public health, safety, and welfare;".

We would therefore propose that the University of Hawaii serve as the supervising contractor for the planned hole. The Principal Investigator, who will oversee all operations at the drill site, will be responsible for compliance with any conditions imposed on the permit for this hole.

WELL LOCATION
The well site is located in an abandoned quarry that is on State of Hawaii Department of Transportation lands that are managed by the Hilo International Airport; the land is zoned Urban and has a Limited Industrial use classification. Use of these lands will be under a Revocable Permit issued by the Airports Division; application for the Revocable Permit has been made to the Department of Transportation and is pending. Use of Airport lands for the proposed purpose has been approved by the Board of Land and Natural Resources.

The specific site of the well within the quarry has not yet been determined and will be defined after the issuance of the revocable permit specifying the parcel of land in the quarry that will be made available to us and after site clearing has been completed.

USE OF THE WELL
The purpose of the subject well is to collect samples of each basalt flow that underlies the drill site down to a depth of 4,500 m. These samples will be analyzed for chemical and isotopic make-up, for physical morphology, for age, and for magnetic characteristics. The data generated will be used in the scientific study of the planetary processes that have formed the Hawaiian Archipelago. The borehole will also be used to study the shallow and deep hydrology of the area and to develop a better understanding of water transport processes in the near-surface environment as well as in the deep, seawater saturated, system.
8. REMARKS, EXPLANATIONS: (cont.)

USE OF THE WELL (cont.)
After drilling operations are complete, the well will be used in a series of geophysical studies that will include vertical seismic profiling, seismic tomography, and passive seismic monitoring of the volcanic edifice.

Additional detail on the activities undertaken with this project and future uses of the well are described in the attached Final Environmental Assessment.

IMPACT ON WATER SUPPLIES
The location of the project site is below the Underground Injection Control line and, hence, the likely impact of this well on potable water supplies is insignificant. As progress is made in drilling the well, casings will be cemented in place through the shallow, freshwater aquifer and will preclude any long-term impact on this system. Further, there are neither private nor municipal water wells currently in operation in close proximity to the proposed well sites.

ADMINISTRATIVE AND REGULATORY ACTIONS
The following administrative or regulatory actions have been completed, are pending, or will be applied for:

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</table>

WELL DISPOSITION
The planned lifetime of the drilling program is approximately five years. At the conclusion of drilling, the project site will be returned to the control of the Airports Division with an agreement that will continue to permit access to the deep hole for long-term geophysical monitoring purposes. We expect that the unique character of the well will enable us to continue using it for these purposes for the foreseeable future. However, if it should become apparent that no further experimentation is likely to occur in the hole, it will be plugged and abandoned as required by DLNR.
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE AVERAGE RANGE TO HIGH IS APPROXIMATELY 3 FEET
APPLICATION FOR PERMIT
☐ Well Construction  ☐ Pump Installation

Instructions: Please print in ink or type and send completed application with attachments to the Commission on Water Resource Management, P.O. Box 621, Honolulu, Hawaii 96809. Application must be accompanied by a non-refundable filing fee of $25.00 payable to the Dept. of Land and Natural Resources. The Commission may not accept incomplete applications. For assistance, call the Regulation Branch at 587-0225.

1. APPLICANT: (may be a, b, or c, but all must be filled in)
   (a) WELL OWNER
      Firm/Name  University of Hawaii
      Contact Person  Donald Thomas  Ph: 956-6482
      Address  HIGP, 2525 Correa Road
               Honolulu, HI 96822
   (b) LANDOWNER
      Firm/Name  DoT, Airport Division
      Contact Person
      Address
   (c) CONTRACTOR
      Firm/Name
      Ph:  
      Contractor’s C-57 License No.
      Address

2. WELL LOCATION/NAME:  HSDP  Island Hawaii
   Address  Hilo International Airport
   (Attach a USGS map, scale 1"=2000', and a property tax map showing well location referenced to established property boundaries.)

3. (a) PROPOSED WORK:
   ☐ Drill New Well  ☐ Alter Location
   ☐ Modify Existing Well  ☐ Redrill
   ☐ Install New Pump  ☐ Replace Pump
   ☐ Deepen  ☐ Modify Pump
   * Be sure to complete and submit well abandonment report upon completion of work.
   (b) WELL TYPE:
   ☐ Dug  ☐ Bored  ☐ Driven  ☐ Drilled  ☐ Radial
   Is this well a part of a battery of wells?  ☐ Yes  ☐ No
   (Briefly describe and fill in the diagram on the back of this form.)

4. PROPOSED PUMP INFORMATION:
   Rated Pump Capacity:  none  gallons per minute
   Motor:
   ☐ Diesel  ☐ Gas
   ☐ Electric, rated horsepower of
   Pump Type:
   ☐ Deep Well Turbine  ☐ Rotary
   ☐ Submersible  ☐ Propeller
   ☐ Centrifugal  ☐ Reciprocating
   ☐ Rotary-Gear  ☐ Impulse

5. PROPOSED USE:
   ☐ Municipal (including hotels, stores, etc.)  ☐ Military
   ☐ Domestic (Individual, noncommercial water sys.)  ☐ Industrial
   ☐ Irrigation (crop)  ☐ Other (explain)
   State Land Use District:
      ☐ Urban  ☐ Agriculture  ☐ Rural  ☐ Conservation
   County Zoning (describe)
   (If more space is needed, continue below under remarks, explanations.)

6. (a) PROPOSED AMOUNT OF WITHDRAWAL:  none  gallons per day
   (b) METHOD OF FLOW MEASUREMENT:
      ☐ Flow-meter  ☐ Open-pipe  ☐ Orifice Plate  ☐ Weir

7. PENDING ACTIONS:
   ☐ CDUA  ☐ SMA  ☐ EIS  ☐ EA  ☐ NONE  ☐ Other (explain)

8. REMARKS, EXPLANATIONS:  see attached

(If more space is needed, continue on back)
APPLICATION FOR PERMIT

Well Construction or Pump Installation

1. APPLICANT: (may be a, b, c, or d, but all must be filled in)
   (a) WELL OWNER
   Firm/Name: University of Hawaii
   Contact Person: Donald Thomas
   Phone: 956-6482
   Address: HIGP, 2525 Correa Road
   Honolulu, HI 96822

   (b) LANDOWNER
   Firm/Name: Dot, Airport Division
   Contact Person: Ph:
   Address:

   (c) CONTRACTOR
   Firm/Name: See attached
   Phone:
   Contractor's C-57 License No:
   Address:

2. WELL LOCATION/NAME: HlSP-3 Island: Hawaii
   Address: Hilo International Airport
   Tax Map Key: 2-13:12:9
   (Attach a USGS map, scale 1" = 2000', and a property tax map showing well location referenced to established property boundaries.)

3. (a) PROPOSED WORK:
   - Drill New Well
   - Modify Existing Well
   - Install New Pump
   - Replace Pump
   - Deepen
   - Modify Pump
   - * Be sure to complete and submit well abandonment report upon completion of work.

   (b) WELL TYPE:
   - Dug
   - Bored
   - Driven
   - Drilled
   - Radial
   - Is this well a part of a battery of wells?
   - Yes
   - No
   (Briefly describe and fill in diagram on the back of this form.)

4. PROPOSED PUMP INFORMATION:
   Rated Pump Capacity: 300 gpm
   Gallons per minute

   Pump Type:
   - Deep Well Turbine
   - Submersible
   - Centrifugal

   Motor:
   - Rotary
   - Rotary-Displacement
   - Reciprocating
   - Impulse
   - Electrical, rated horsepower of

5. PROPOSED USE:
   - Municipal (including hotels, stores, etc.)
   - Military
   - Domestic (individual, noncommercial water systems)
   - Industrial
   - Irrigation (crop)
   - Other (explain)
   - State Land Use District:
     - Urban
     - Agriculture
     - Rural
     - Conservation
   - County Zoning (describe)
   - (If more space is needed, continue below under remarks, explanations.)

6. (a) PROPOSED AMOUNT OF WITHDRAWAL: 450,000 gallons per day

   (b) METHOD OF FLOW MEASUREMENT:
   - Flow-meter
   - Open-pipe
   - Orifice Plate
   - Weir

7. PENDING ACTIONS:
   - CDUA
   - SMA
   - EIS
   - EA
   - None
   - Other (explain)

8. REMARKS, EXPLANATIONS:
   - See attached
   - (If more space is needed, continue on back)

NOTE: Signing below indicates that the applicant understands that, if the permit requested is granted by the Commission on Water Resource Management, the proposed work is to be completed within two (2) years of the approval date. In addition, the contractor shall submit to the Commission a well completion report, well abandonment report, or both, within 30 days after the completion date of the permitted work. The applicant also understands that monthly water use data shall be submitted to the Commission. The applicant further understands that approval of the proposed permit shall not constitute a determination of correlative water rights and shall not guarantee the pump capacity or future use up to the permitted pump capacity.

Well Owner: University of Hawaii

Landowner: Dot, Airport Division

Contractor:

Signature: ____________________________
Date: ________

Signature: ____________________________
Date: ________

Signature: ____________________________
Date: ________

For Official Use Only:
Date Received
Date Accepted
Field Checked By ____________________________
Date: ________

Longitude: ____________________________
Latitude: ____________________________

Aquifer System Name: __________
State Well No: __________

6/24/92 WCM F
9. PROPOSED WELL SECTION

Elevation at top of casing: 26 ft., msl.

Ground Elevation: 24 ft., msl*

Cement Grout: to 26 ft.

Rock Packing: to 40 ft.

Hole Diameter: 16 in.

Total Depth: 45 ft.

Solid Casing:
Material: Carbon steel
Length: 28 ft.
Diameter: 12 in.
Wall thickness: 0.25 in.

Casing: [ ] Perforated  [ ] Screen
Material: Carbon steel
Length: 14 ft.
Diameter: 12 in.
Wall thickness: 0.25 in.
Openings: ______ sq. in./L.F.

Open Hole:
Length: 5 ft.
Diameter: 18 in.

*Approximate elevation at time of filing application. Ground elevation above mean sea level (msl) by a surveyor licensed by the State must be submitted at start of construction. Final elevations of well components shall be submitted in the well completion/well abandonment reports.
8. REMARKS, EXPLANATIONS:

CONTRACTOR
Selection of the drilling contractor will be by competitive bid. Requests for bids will be issued after a number of administrative and regulatory issues are resolved and we have a confirmed starting date for the drilling project. Currently, our estimate of a start date is in the fourth quarter of 1998.

WELL LOCATION
The well site is located in an abandoned quarry that is on State of Hawaii Department of Transportation lands that are managed by the Hilo International Airport; the land is zoned Urban and has a Limited Industrial use classification. Use of these lands will be under a Revocable Permit issued by the Airports Division; application for the Revocable Permit has been made to the Department of Transportation and is pending. Use of Airport lands for the proposed purpose has been approved by the Board of Land and Natural Resources.

The specific site of the well within the quarry has not yet been determined and will be defined after the issuance of the revocable permit specifying the parcel of land in the quarry that will be made available to us and after site clearing has been completed.

USE OF THE WELL
The purpose of the subject well will be for the production of non-potable water that is to be used in the drilling of a deep geophysical observation hole. The maximum water usage rate for drilling is estimated to be about 300 gpm during short intervals of hole flushing while we are “opening” the deep hole. The quality of the water, in terms of salinity, is not a significant consideration since the deeper hole will be drilled into saltwater saturated basalts and, hence, the drilling fluids will have to be tolerant of high salt concentrations.

After drilling operations are complete, the well will be used in a seismic experiment for the installation of a seismic source (an air gun) that will enable us to better characterize the subsurface volcanic structure around the site. The need for the installation of the seismic source is the controlling factor in the selection of the well diameter.

IMPACT ON WATER SUPPLIES
The location of the project site is below the Underground Injection Control line and, hence, the likely impact of this well on potable water supplies is insignificant. Further, there are neither private nor municipal water wells currently in operation in close proximity to the proposed well sites.
8. REMARKS, EXPLANATIONS: (cont.)

**ADMINISTRATIVE AND REGULATORY ACTIONS**
The following administrative or regulatory actions have been completed, are pending, or will be applied for:

<table>
<thead>
<tr>
<th>Action</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Assessment</td>
<td>Completed, Finding of No Significant Impact</td>
</tr>
<tr>
<td>Air Emissions Permit</td>
<td>Approved</td>
</tr>
<tr>
<td>Community Noise Permit</td>
<td>Submitted, pending</td>
</tr>
<tr>
<td>Community Noise Variance</td>
<td>Submitted, pending</td>
</tr>
<tr>
<td>Well Drilling Permit (deep hole)</td>
<td>Submitted, pending</td>
</tr>
<tr>
<td>Well Drilling Permit (this application)</td>
<td>Submitted, pending</td>
</tr>
<tr>
<td>Hawaii County Plan Approval</td>
<td>To be submitted</td>
</tr>
<tr>
<td>FAA Notice of Proposed Construction</td>
<td>To be Submitted</td>
</tr>
</tbody>
</table>

**WELL DISPOSITION**
The planned lifetime of the drilling program is approximately five years. At the conclusion of drilling, the project site will be returned to the control of the Airports Division and the ownership of the well will be transferred to them should they so desire. If the Airports Division has no foreseeable use for the well, then it will be plugged and abandoned as per instructions from Department of Land and Natural Resources.
Figure 6 Diagram showing hole casing program and proposed phasing of the drilling effort
TO: Honorable Lawrence Miike, Director
Department of Health
Attention: Dennis Tulang, Wastewater Branch
William Wong, Safe Drinking Water Branch

FROM: Michael D. Wilson, Chairperson
Commission on Water Resource Management

SUBJECT: Well Construction Permit Application
HSDP Wells (Well Nos. 4203-16 and 17)

Transmitted for your review and comment is a copy of the captioned well application.

We would appreciate your comments on the captioned application for any conflicts or inconsistencies with the programs, plans, and objectives specific to your department. Please respond by returning this cover memo form by June 20, 1998.

Please find a map, attached, to locate the proposed well. If you have any questions about this permit application, request additional information, or request additional review time, please contact Mr. Ryan Imata of the Commission staff at 587-0255.

RESPONSE:

[ ] This well qualifies as a source which will serve as a source of potable water to a public water system (serving 25 or more people at least 60 days per year or has 15 or more service connections) and must receive Director of Health approval prior to its use to comply with Hawaii Administrative Rules (HAR), Title 11, Chapter 20, Rules Relating to Potable Water Systems, §11-20-29.

[ ] This well does not qualify as a source serving a public water system (serves less than 25 people or more people at least 60 days per year or 15 service connections) and if the well water is used for drinking, the private owner should test for bacteriological and chemical presence before initiating such use and routinely monitor the water quality thereafter. However, if future planned use from this source increases to meet the public water system definition then Director of Health approval is required prior to implementation.

[ ] If the well is used to supply both potable and non-potable purposes in a single system, the user shall eliminate cross-connections and backflow connections by physically separating potable and non-potable systems by an air gap or an approved backflow preventer, and by clearly labeling all non-potable spigots with warning signs to prevent inadvertent consumption of non-potable water. Backflow prevention devices should be routinely inspected and tested.

[ ] It does not appear that this well will be used for consumptive purposes and is not subject to Safe Drinking Water Regulations.

[ ] For the applicant’s information, a source of possible wastewater contamination [] is located near the proposed well site (information attached).

[ ] Other relevant DOH rules/regulations, information, or recommendations are attached.

[ ] No comments/objections.

Contact Person: William Wong
Phone: 586-4258

Signed: William Wong
Date: 06/12/98
TO: Honorable Lawrence Miike, Director  
Department of Health  
Attention: Dennis Tulang, Wastewater Branch  
William Wong, Safe Drinking Water Branch

FROM: Michael D. Wilson, Chairperson  
Commission on Water Resource Management

SUBJECT: Well Construction Permit Application  
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If the well is used to supply both potable and non-potable purposes in a single system, the user shall eliminate cross-connections and backflow connections by physically separating potable and non-potable systems by an air gap or an approved backflow preventer, and by clearly labeling all non-potable spigots with warning signs to prevent inadvertent consumption of non-potable water. Backflow prevention devices should be routinely inspected and tested.

It does not appear that this well will be used for consumptive purposes and is not subject to Safe Drinking Water Regulations.

For the applicant's information, a source of possible wastewater contamination [ ] is [ ] not located near the proposed well site (information attached).

Other relevant DOH rules/regulations, information, or recommendations are attached.

No comments/objections

Contact Person: Lori N. Kajiwara  
Phone: 586-4294

Signed: Lori N. Kajiwara  
Date: 6/15/98
The Department of Health, Clean Water Branch has the following comments:

1. For Well-Drilling Activities

   Any discharge to State waters of treated process wastewater effluent associated with well drilling activities is regulated by Hawaii Administrative Rules, Chapter 11-55, Appendix I, effective September 22, 1997. Treated process wastewater effluent covered by this general permit includes well drilling slurries, lubricating fluids wastewaters, and well purge wastewaters. This general permit does not cover well pump testing. The applicable Notice of Intent Forms and filing fee shall be submitted at least thirty (30) days before the start of discharge to the Department of Health, Clean Water Branch at 919 Ala Moana Boulevard, Room 301, Honolulu, Hawaii 96814-4920 or P.O. Box 3378, Honolulu, Hawaii 96801-3378. Inquiries may be directed to the Clean Water Branch at (808) 586-4309 or by fax at (808) 586-4352.

2. For Well Pump Testing

   The discharger shall take all measures necessary to prevent the discharge of pollutants from entering state waters. Such measures shall include, if necessary, containment of the initial discharge until the discharge is essentially free of pollutants. If the discharge is entering a stream or river bed, best management practices shall be implemented to prevent the discharge from disturbing the clarity of the receiving water. If the discharge is entering a storm drain, the discharger must obtain written permission from the owner of that storm drain prior to discharge. Furthermore, best management practices shall be implemented to prevent the discharge from collecting sediments and other pollutants prior to entering the storm drain.

JS/cr
February 14, 1997

Mr. Roy Hardy
Water Resources Management Division
DLNR
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Hardy:

Enclosed is a copy of the Final Environmental Assessment and Finding of No Significant Impact for the Hawaii Scientific Drilling Project. As you will see in Appendix C, as well as separate letters to individual agency staff and members of the public, we have attempted to address the concerns raised with the Draft Environmental Assessment that was sent out for review. Judging from the degree of response we have received from the Draft, there appear to be few objections to the project being located at the proposed sites and there do not appear to be any adverse impacts that cannot be substantially mitigated with available technology. We have, therefore, made a determination that there will be no significant impact arising from the project at either of the sites that are presently under consideration.

As we move forward on detailing the project design for the specific site, the rig size and capacity, the project schedule, etc., we will be contacting you to identify the individual permits that will be needed and the requirements that need to be met to obtain those permits. In the mean time, should any questions arise regarding our project, please feel free to contact me (956-6482) at your convenience.

Sincerely yours,

Donald M. Thomas
December 2, 1996

Mr. Roy Hardy
Water Resources Management Division
Dept. Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Hardy:

Enclosed is a copy of the Draft Environmental Assessment for the Hawaii Scientific Drilling Project. I thought that you might be interested in reviewing the official Draft that will be circulated for public comment. The Office of Environmental Quality Control will publish its summary in the December 8th Bulletin; the public comment period is open until January 7. If you find anything that you think I should change or expand on in the Draft, please feel free to comment on it and I will include the revisions in the Final EA. As I may have mentioned to you earlier, we expect to do a FONSI since we intend to do the project in one of the two quarries that are described in the Draft EA. If you would like to submit official comments via OEQC, they have a new address:
The Office of Environmental Quality Control
235 S. Beretania St. #702
Honolulu, HI 96813.

If you could also send a copy to me at the address below, I would appreciate it.

Thank you.

Sincerely yours,

Donald M. Thomas
August 25, 1993

Mr. Manabu Tagamori
Director
Water Resources Management Division
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96813

Dear Mr. Tagamori:

I would like to request from your Department, a permit that will allow me to drill a scientific research hole in the vicinity of Hilo Harbor. The proposed location of the drilling project is on portions of two State-owned parcels of land (TMK 2-1-09-1 and TMK 2-1-09-41) located between the Keaukaha sewage treatment plant and the Texaco fuel storage area on Kalanianaole Ave. (see attached map).

The purpose of the drilling project is to sample the lava flows that are present below this part of Hilo down to a depth of approximately 2000 ft. to 3000 ft. (see attached detailed discussion of the scientific objectives of the program). The drilling procedure will be identical to that used during the Scientific Observation Hole program, conducted in the Puna District by the University of Hawaii, in which samples of core were continuously removed from the hole during the drilling procedure. The drilling contractor that has been selected for the drilling program (Tonto Drilling Co.) will be the same one that performed that drilling and hence has had extensive experience in core drilling of Hawaiian basalts. The proposed hole will, however, not be as deep as those in Puna nor is this hole expected to encounter elevated temperatures.

The design of the proposed hole is as shown in the attached drawing. The upper section of casing will be approximately 4.5 inches in diameter and will be cemented in place down to a depth of between 75 ft. and 200 ft. depending on drilling conditions. The subsequent string of HQ casing will also be cemented in place to a depth of approximately 1200 ft. with the bottom hole interval left open to allow downhole logging measurements to be performed after well completion. (If adverse drilling conditions are encountered during drilling, a third string of casing may also be left in place at well completion.) The total depth of the hole will depend on the drilling conditions encountered as well as the duration of the drilling. The drilling time will be no more than 45 days as required by our Right-of-Entry (see below) issued by the Department of Land and Natural Resources, Land Management Division.

As noted above, we do not anticipate encountering elevated temperatures in the well. None-the-less, we will be monitoring downhole temperatures during drilling and, if unusual temperature increases are observed, we will immediately halt further drilling and notify your department. Our
drilling plan also includes the use of a BOPE to allow us to control any artesian aquifers that might be encountered. Finally, we will be both logging the hole during drilling and sampling fluids from the hole at intervals. This data can be provided to you as required.

The present status of the project is as follows:

1) A Right-of-Entry was issued by the Department of Land and Natural Resources, Land Management Division in June of this year. As part of this process, an Environmental Assessment was performed and resulted in a Negative Declaration by the Department. The Right-of-Entry and the EA are being forwarded to you under separate cover.

2) A Special Management Area Petition has been submitted to the County of Hawaii Planning Department. A public hearing for this petition will be heard by the Planning Commission on August 26, 1993; the recommendation by the Planning Director to the Commission is that the project be approved with appropriate conditions for mitigating noise and lighting impacts from the drilling project. A copy of the SMA petition is also being sent to you.

Thank you for your assistance on this request and, should you have any questions regarding our proposed project, please contact me at your convenience.

Sincerely yours,

Donald M. Thomas
for: C.B. Raleigh
Dean
School of Ocean and Earth Science and Technology
Hawaii Pilot Hole
Proposed Hole Design

BQ Rod Cemented To ~ 200 ft.

HQ Rod Set and Cemented to ~1200 ft.

Open Hole

Total Depth ~ 3000 ft.
Scientific Objectives of the Hawaii Deep Hole Project

The deep research drill hole that is proposed for the Island of Hawaii will allow us to study a number of questions relevant to earth sciences, island and volcanic structure, hydrology, and geologic hazards. The most important of these, and the one that has given the greatest justification for the drilling program, relates to the processes that are responsible for the formation of the Hawaiian Island chain.

Our current state of knowledge regarding the source of the volcanism is that there is some form of anomaly within the mantle, referred to as a plume or "hot spot" that allows molten rock from the mantle to discharge onto the ocean floor and build up the seamounts and islands that form the Hawaiian Archipelago. This anomaly has existed for tens of millions of years, apparently in the same location relative to the core of the earth, and has successively formed the island chain as the Pacific Crustal Plate has moved northward over it. Beyond this general recognition of a unique feature in the mantle being responsible for Hawaii's volcanism, we know very little more about its causes or mechanism of operation. Hence, the dominant purpose of the proposed drilling program is to sample a sequence of lava flows through as much of the life-cycle of a single volcano as possible.

The samples obtained will be subjected to detailed chemical and mineralogical analyses in an effort to determine how the mantle magma source evolves during the formation of a volcanic edifice and to determine whether the variations within and between volcanic systems represent a continuous process or a series of episodic events in the history of the mantle anomaly.

We would note here that, although it clearly is possible to sample lavas from the surface of a long series of volcanic systems along the Hawaiian chain, the only way to study the history of a single volcanic system is by drilling into it. This is because each volcanic system, as it forms, begins to deform the Pacific Crustal Plate, forcing it downward into the mantle. This results in a steady sinking of the island and, over a period of several million years, it gradually subsides beneath the surface of the ocean. Hence, much of the volcano is never exposed through processes of erosion and cannot be sampled without drilling.

In addition to the above studies, the drilling program will allow us to study the deep structure of an island volcano and will enable us to determine exactly how the edifice is built up on the ocean floor; how it interacts with the surrounding seawater; if and how freshwater recharge moves through the deeper portion of the island; and how seismic energy is transmitted through the volcanic system. Although much of this research can be classified as basic investigation of volcanic processes, the data generated will be
useful in assessing groundwater hydrology and freshwater reserves, seismic hazards, rates of subsidence of the island, and the prospects for catastrophic slumping events that have only recently been recognized as playing a major role in island erosional processes.

The drilling program will be undertaken in two phases: a pilot drill hole and a final deep hole. The purpose of the pilot hole is to determine the feasibility of drilling into subaerial and submarine lava flows using diamond coring technology. Although this technology has been used in Puna, that work was done in close proximity to the eruptive vents that generated the lava flows. Because the proposed deep hole has been located as far away from eruptive vents as possible, it is considered prudent to test the technology in the same rock types as will be encountered in the deep hole before making a major commitment of funds for deep drilling. Thus the primary objective of the pilot hole is to demonstrate the technical feasibility of the drilling technology. This hole will also serve several secondary objectives as well: sampling and analysis of the lava flows will enable us to determine the variability of flow compositions in this area; age dating of the lava flows or reef deposits between the flows will enable us to estimate the recurrence interval of Mauna Loa lava flows that have covered the Hilo area; and water sampling and analysis will provide information on water quality and the shallow groundwater hydrology along the coastal region of Hilo.

Criteria for Site Selection

The issues considered in the selection of the site for drilling the deep hole can be classified as follows: scientific, logistic, environmental, and legal. The scientific criteria that were considered to be essential in the site selection were that:

1) the drill hole should span the greatest length of history of the volcano over a minimum hole depth;
2) the hole should be located so as to minimize the likelihood of passing through one volcano and into lavas derived from an older, underlying volcanic system;
3) the potential for chemical/hydrothermal alteration of the lavas should be minimized.

The site chosen to meet these criteria was located as follows:

1) a site close to the coast will sample only those lava flows that have been large enough to reach a distance of nearly 30 km from the nearest active rift zone and hence, the much thicker sequence of short lava flows near the vents will be avoided;
2) because the sequence of formation of the volcanoes is from north to south, drilling on the northern flank of the volcano will increase the likelihood of drilling into the older volcano (in this case, Kohala Volcano) that may underlie that flank of Mauna Kea and hence, a site on the southern flank is indicated as preferable;
3) because hydrothermal alteration of the rocks can greatly complicate the interpretation of the chemical compositions, the
site was located as far from the prior caldera or active rift zones of the volcano as possible.

The logistical considerations are primarily associated with access and the degree of site work required to enable a drill rig to operate efficiently. A flat site having an existing roadway in close proximity to the commercial and industrial areas of the Big Island were considered to be optimal.

The environmental issues of concern were that we not disturb the natural or socio-economic environment any more than necessary and that our activities be as compatible as possible with prior or existing land uses. The preferred site was one that had already been disturbed by prior uses and one in which a drilling rig would cause the least disruption of accepted use (e.g. urban/industrial areas).

The legal criteria were largely that the drilling activity not impact other approved uses of the land nor raise legal issues not directly relevant to the proposed drilling activities. Also of importance was that the purposes for which the funds would be expended on this project must meet the guidelines of the agencies providing the funds. Hence, we considered state-owned land that was not reserved for other agency use to be the least likely to encounter legal difficulties.

We believe that the state-owned parcels located in the vicinity of Hilo Harbor best meet the criteria listed above. Although sites further inland (e.g. state-owned land currently used for the airport) could be used, we believe that this area would have significant scientific and legal penalties associated with its use. These would include the much longer sequence of lava flows that would have to be drilled through in order to reach the now buried coastline and to reach Mauna Kea lavas beneath the present veneer of Mauna Loa lavas. Placement of the drilling rig would also have to comply with FAA regulations regarding the mast height and distance from the runway.
The University of Hawaii has requested the approval of the Board of Land and Natural Resources for the temporary use of approximately one-half acre of State land located one-half mile east of the Hilo Harbor dock along Kalaniana‘ole Avenue. (see parcels identified by THK 2-1-09:01 and 2-1-09:41 in the attached copy of THK map). The requested access is made in order to allow the University of Hawaii School of Ocean and Earth Science and Technology, in collaboration with the University of California at Berkeley and Cal Tech University, to drill a research well to a depth of approximately 600 meters (2000 ft.). The proposed project will be funded by the National Science Foundation.

The objective of the proposed drilling effort is to test the feasibility of drilling into subaereal and submarine lava flows and obtaining continuous core samples using diamond coring technology. This work is intended to be the first phase of a longer term project that will sample an extended sequence of lava flows of Mauna Kea volcano down to a depth of approximately 4.5 km (14,500 ft.). Any drilling beyond the proposed 600 meter hole will, however, depend on whether this first hole can be successfully drilled and on the scientific reviews of the work conducted in the pilot hole. A detailed description of the scientific objectives of the longer term project is attached as Appendix I.

These parcels were chosen as our drilling site because they best meet a number of scientific, environmental, and legal considerations. The scientific considerations (presented in more detail in Appendix I) include the following: drilling at this site is likely to encounter submarine lava flows at the shallowest possible depth; it is likely that this site will allow us to sample a long history of Mauna Kea lava flows but will have a low potential of encountering deeply buried flows from Kohala volcano; the site is well removed from either the Mauna Loa or Mauna Kea rift zones and hence is unlikely to encounter elevated subsurface temperatures or hydrothermally altered rocks.

The environmental considerations that recommend this site are: it is located in an Urban Land Classification District and is designated by the County for General Industrial Use; the land surface has already been heavily disturbed by its use as an access to Hilo Harbor during construction of the breakwater; it is adjacent to the Hilo Dock, a fuel storage facility, and the Keaukaha waste water treatment plant. Hence, the environmental impacts from the proposed drilling will be insignificant relative to prior use of the site and the currently existing activities in
the surrounding areas. The relevant legal issues include: the State ownership of these parcels and our likely inability to lease privately-owned property using NSF funds for this purpose; and the next most scientifically acceptable, State owned, parcel is located on lands currently used by the Hilo airport and, hence, we may encounter difficulties in obtaining permission to erect a drilling mast in close proximity to the airport runway.

Although the above considerations make these two parcels the first choice for our project, the location of any activities on these parcels can be adjusted as directed by the Board in order to minimize their impacts on the adjacent community, the environment, or on future uses of these parcels by DLNR or any other State agency.

The project will include: a drill pad approximately 30 m by 60 m will be cleared; a wellhead cellar (2 m x 2 m x 1.5 m) will be constructed and a reinforced concrete well head pad (5 m x 5 m) and cover poured; drilling will commence with a core/cable rig to a depth of 25 m; well casing will be cemented in place; core drilling will continue to a depth of 600 m; down hole measurements will be periodically made during the drilling and at the completion of the drilling; a wellhead valve will be attached and the well pad cover installed to secure the well from vandalism. The duration of the drilling program is expected to be on the order of four to six weeks with periodic downhole measurements and monitoring to be performed for a period of several months after well completion.

At the conclusion of the drilling and subsequent analysis of the recovered cores, a decision will be made as to whether a deeper drill hole will be considered by NSF. If funding is to be made available, a request will be submitted to DLNR for continued use of the currently proposed site or, if necessary, an alternative site on which to drill the 4.5 km depth hole. If no further work is to be conducted at this site, the well will be either plugged and abandoned or dedicated to long term research use as deemed appropriate by the BLNR.

An Environmental Assessment has been prepared that provides our best estimate of all potential impacts that may arise from the proposed project. A copy of this document is available on request to the School of Ocean and Earth Science and Technology.

The limited scope of the proposed project will clearly limit the benefits that are likely to accrue to the State and County of Hawaii from its completion. However, this work will enable us to make better estimates of the recurrence interval of lava flows that have reached the coastal area in this region and, hence, can provide more accurate estimates of the potential lava flow hazards to which Hilo is exposed from Mauna Loa Volcano. Observations of subsurface lava flows will also enable us to make better estimates of coastal subsidence rates as well as the seismic risks to which the major population center of the island is exposed. The hole
will also provide an opportunity to sample groundwaters in this region and allow us to better define the hydrology of the Hilo area and its potential water resources.

Should you need additional information regarding this planned project, please contact Dr. C.B. Raleigh at the above address.
GEOPHYSICAL RESEARCH HOLE DRILLING PERMIT

Hawaii Pilot Hole
Waikea, South Hilo, Hawaii

TO: University of Hawaii
School of Ocean & Earth Science & Technology (SOEST)
2525 Correa Road
Honolulu, Hawaii 96822

Your application, dated August 25, 1993, for a permit to drill a geophysical research hole on State-owned land located in Waikea, South Hilo, Hawaii for the purpose of recovering rock core samples and gathering down-hole geophysical data for scientific research, is approved.

Well Designation: Hawaii Pilot Hole
Location: TMK 2-1-09-1 and 2-1-09-41, Waikea, South Hilo, Hawaii
Land Owner: State of Hawaii
Operator: University of Hawaii, SOEST
Ground Elevation: 8 +/- ft. Above Mean Sea Level
Projected Depth: 2,000 to 3,000 +/- ft. True Vertical Depth

Approval is granted in accordance with the following conditions:

(1) All work shall be performed in accordance with the requirements and terms of the occupiers of the land; the Drilling and Completion Program submitted with your application; Hawaii Revised Statutes, Chapter 178; and all other applicable statutes, ordinances, rules and regulations of the Federal, State, and Hawaii County governments;

(2) The permittee, its successors and assigns shall indemnify, defend and hold the State of Hawaii harmless from and against any loss, liability, claim or demand for property damage, personal injury and death arising out of any act or omission of the applicant, assigns, officers, employees, contractors and agents under this permit or relating to or connected with the granting of this permit;

(3) The permittee shall observe and comply with all valid requirements of Federal, State and County authorities and regulations pertaining to lands and permittee's operations including, but not limited to, all water, air, and noise pollution control laws and those relating to the environment;
(4) The well and bottom-hole location shall be located more than 100 feet from the outer boundary of the parcel of land on which the well is situated, or more than 100 feet from a public road, street, or highway dedicated prior to the commencement of drilling, unless modified by the Chairperson upon request;

(5) The permittee shall notify the Division of Water and Land Development (DOWALD), in writing, of the date of the start of drilling operations;

(6) If elevated down-hole temperatures are observed, the permittee shall immediately halt operations and notify DOWALD;

(7) If changes to the proposed drilling program are contemplated, the permittee shall obtain the Chairperson's approval before executing such changes;

(8) When drilling has reached a depth of not more than 50 feet below sea level, the Department's representative shall be notified, with reasonable time allowed for travel to the site, to witness the retrieval of a representative ground water sample and the measurement of the static water level. The permittee shall have the sample analyzed by an independent laboratory and have the results submitted to the Department;

(9) During the use of the well for testing, monitoring, or coring purposes, the well and site shall be properly maintained until the well is plugged and abandoned;

(10) The permittee shall submit to the Chairperson, the results of any exploration, all drilling and testing records, down-hole surveys of the well, bottom-hole location, date of completion, and a survey of the well location and elevation above mean sea level taken by a Hawaii licensed surveyor within six months after completion of the well;

(11) A well completion report, an as-built drawing of the well, and the location of the well plotted on a U.S.G.S. quad map shall be filed with the Department within six months after completion of the well;

(12) If no further work is to be conducted at the site, the well will be either plugged and abandoned with surface restored as near as possible to its original condition, or dedicated to long-term research use as deemed appropriate by the Department; and
This permit shall expire 365 calendar days from the date of issuance.

SEP - 2 1993
Date of Issuance

c: Land Board Members
   Hawaii County Planning Dept.
   DBEDT
   Dept. of Health
   OEQC, DOH

KEITH W. AHUE, Chairperson
Department of Land and Natural Resources